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# The effectiveness, cost-effectiveness and policy processes of regulatory, voluntary and partnership policies to improve food environments: an evidence synthesis

*Laurence Blanchard, Stephanie Ray, Cherry Law, María Jesús Vega-Sala, Julia Bidonde, Gemma Bridge, Matt Egan, Mark Petticrew, Harry Rutter and Cécile Knai*





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# Abstract

## The effectiveness, cost-effectiveness and policy processes of regulatory, voluntary and partnership policies to improve food environments: an evidence synthesis

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**Background:** Dietary factors are among the largest and costliest drivers of chronic diseases in England. As a response, the government implements a range of population interventions to promote healthy diets by targeting food environments.

**Objectives:** This study aimed to conduct a systematic review of the effectiveness, cost-effectiveness and policy process of real-world evaluations of national and state policies on improving food environments, with a focus on whether they were regulatory, voluntary or partnership approaches.

**Data sources:** Fourteen relevant English-language databases were searched in November 2020 for studies published between 2010 and 2020.

**Methods:** Six separate evidence reviews were conducted to assess the evidence of effectiveness, cost-effectiveness and policy processes of policies to improve food environments.

**Results:** A total of 483 primary research evaluations and 14 evidence syntheses were included. The study reveals considerable geographic, methodological and other imbalances across the literature, with, for example, 81% of publications focusing only on 12 countries. The systematic reviews also reveal the effectiveness and cost-effectiveness of reviewed regulatory approaches designed to improve health, consumer behaviour and food environment outcomes while public-private partnerships and voluntary approaches to improve diets via reformulation, advertising and promotion restrictions or other changes to the environment were limited in their effectiveness and cost-effectiveness. The study also revealed key enabling and impeding factors across regulatory, voluntary and public-private partnership approaches.

**Conclusion:** From the available evidence reviewed, this study finds that regulatory approaches appear most effective at improving the food environment, and voluntary agreements and partnerships have limited effectiveness. These findings should be carefully considered in future public health

## ABSTRACT

policy development, as should the findings of geographic imbalance in the evidence and inadequate representation of equity dimensions across the policy evaluations. We find that food policies are at times driven by factors other than the evidence and shaped by compromise and pragmatism. Food policy should be first and foremost designed and driven by the evidence of greatest effectiveness to improve food environments for healthier diets.

**Limitations:** This was a complex evidence synthesis due to its scope and some policy evaluations may have been missed as the literature searches did not include specific policy names. The literature was limited to studies published in English from 2010 to 2020, potentially missing studies of interest.

**Future work:** Priorities include the need for guidance for appraising risk of bias and quality of non-clinical studies, for reporting policy characteristics in evaluations, for supporting evaluations of real-world policies equitably across geographic regions, for capturing equity dimensions in policy evaluations, and for guideline development for quality and risk of bias of policy evaluations.

**Study registration:** This study is registered as PROSPERO CRD42020170963.

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# List of supplementary material

**Report Supplementary Material 1** Additional study characteristics and exclusions

**Report Supplementary Material 2** Records included in the evidence map ( $n = 483$ )

Supplementary material can be found on the NIHR Journals Library report page (<https://doi.org/10.3310/JYWP4049>).

Supplementary material has been provided by the authors to support the report and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.



## List of abbreviations

AWASH	Australian Division of World Action on Salt and Health	HWC	healthy weight commitment
BMI	body mass index	HWCF	Healthy Weight Commitment Foundation
CAI	Canadian Children's Food and Beverage Advertising Initiative	LMIC	low- and middle-income country
CASP	Critical Appraisal Skills Programme	NCD	non-communicable disease
CFBAI	Children's Food and Beverage Advertising Initiative (USA)	NGO	non-governmental organisation
CHD	coronary heart disease	NPs	non-participants
CHN	Choose Healthy Now	PPP	public-private partnership
CP	children's programmes	PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
CVD	cardiovascular disease	QALY	quality-adjusted life-year
DALY	disability-adjusted life-year	QSRI	The Quick Service Restaurant Industry's Initiative
EPPI-Centre	Evidence for Policy and Practice Information and Co-ordinating Centre	RCMI	Responsible Children's Marketing Initiative
EU	European Union	RCT	randomised controlled trial
FHD	Food and Health Dialogue	RD	Responsibility Deal
FOP	front of pack	ROBINS-I	Risk Of Bias In Non-randomised Studies of Interventions
FOPL	front-of-pack labelling	SDIL	Soft Drinks Industry Levy
FV	fruit and vegetables	SES	socioeconomic status
GRADE	Grading of Recommendations, Assessment, Development and Evaluation	SIGN	Scottish Intercollegiate Guidelines Network
HALY	health-adjusted life-year	SSB	sugar-sweetened beverage
HFSS	high fat, sugar and/or salt foods	WHO	World Health Organization
HSR	Health Star Rating	WTP	willing to pay



## Plain language summary

Poor diet is a leading cause of death, globally, including in the United Kingdom. It also causes many types of illness and is one of the biggest drains on the United Kingdom National Health Service budget.

Governments act in various ways to promote healthy diets by improving food environments: these are the physical and social surroundings that influence what and how much people eat. Some actions are regulated by government, for example, to control food production, marketing and promotions. Other actions are led by, or with, food businesses, making voluntary changes to the foods they produce, for example, by reducing salt content; this can be done by businesses alone or in partnership with government (referred to as 'public-private partnerships').

The six reviews of published research look at whether, and how, these actions to improve diets work, and whether they can provide value for money.

Most regulations appear to be effective at supporting better diets. However, voluntary changes led by businesses had limited success. There were not many evaluations that assessed the effectiveness of public-private partnerships. Of those that did, partnerships with the food industry had limited effectiveness, resulting in largely unchanged outcomes.

When looking at how these actions improve diets, we found that clear leadership, public support for the policy, the use of the best evidence and of local expertise helped with getting actions implemented. Factors that appear to make it harder to implement policy actions include a lack of evidence specific to the context, conflicting beliefs about what works, limited human or financial resources, lack of engagement by key people.

Although the findings may help us to think about the ways forward to improve diets, more research is needed to understand whether actions to reduce diet-related ill health work, and provide value for money.



# Scientific summary

## Background

Unhealthy diets are now estimated to be responsible for more deaths than any other risk globally, including in England. Dietary factors underpin many of the major chronic diseases currently faced by the population and are estimated both to be the largest contributor to overall disease and to have the highest impact on the NHS budget. It is in this context that the English government has implemented a range of population interventions to promote healthy diets by improving food environments. These range from public-private partnerships (PPPs) and voluntary programmes to regulatory policies, aiming to reduce ingredients like sodium and sugars in foods through interventions, such as reformulation, advertising reduction/bans and labelling.

Governance arrangements in policy are broadly defined here as whether or not a policy intervention is voluntary, PPP or government led. Governance is a key overlooked mechanism in these interventions, and also in reviews of policy responses, and it is a fundamental part of the context, which is insufficiently discussed. It is essential to understand how governance arrangements in policy have an impact on effectiveness, by understanding what factors relating to interventions, providers, populations and settings affect the implementation of such population interventions to improve diet.

## Aims

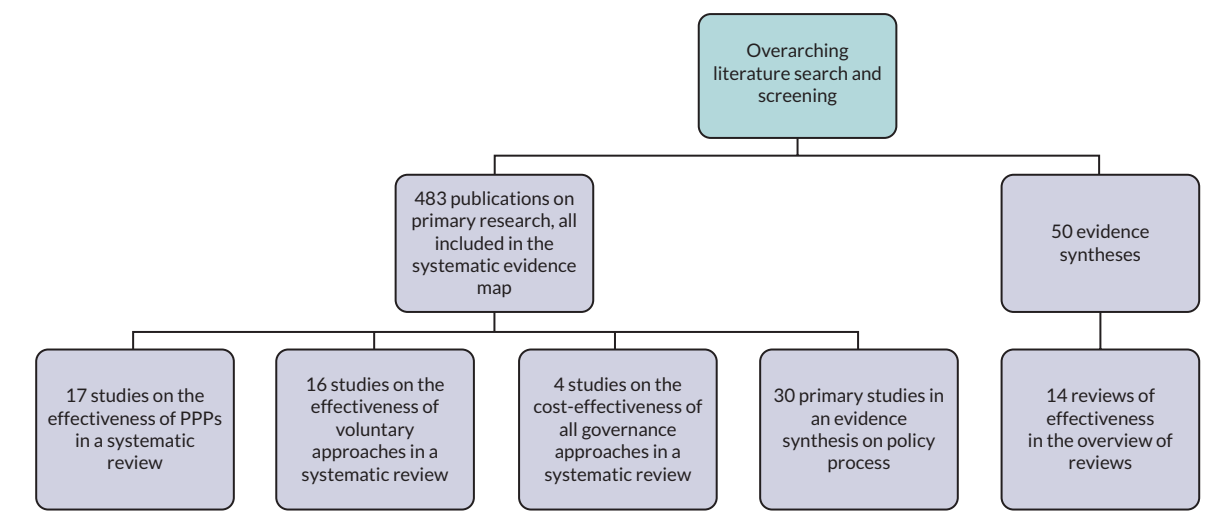
This study, cost-effectiveness and policy processes of population interventions to improve diet with a focus on governance, and with a view to informing the most effective responses to unhealthy diets, formulating implications for diets in England.

## Research questions

1. How are regulatory interventions, voluntary approaches and PPPs to improve diet assumed to work in theory?
2. What regulatory interventions, voluntary approaches and PPPs to improve diet, and reduce inequalities in diet improvement, have been evaluated?
3. What factors relating to interventions, providers, populations and settings affect implementation of such population interventions to improve diet?
4. Have such population interventions improved process, impact (intermediate and distal) and cost outcomes?
5. Are there any reported unanticipated effects of such population interventions?
6. What is the cost-effectiveness of such population interventions?
7. How can the findings of the evidence review be translated into recommendations for improved interventions?

## Methods

This evidence synthesis consists of six individual evidence syntheses based on a common systematic literature search [see [Figure A \(Figure 2\)](#) in main text]. The evidence syntheses consisted of a systematic evidence map of primary research, an overview of reviews on the effectiveness of regulatory, voluntary and PPP approaches, two systematic reviews on the effectiveness of PPPs, and voluntary approaches by private actors to fill gaps in the overview of review, as well as another systematic review on the cost-effectiveness of regulatory, voluntary and PPP approaches, and a qualitative evidence synthesis of the policy process.



**FIGURE A** Relationships between review outputs.

We ran searches of real-world evaluations of policies (defined as evaluations conducted while the policy was adopted or implemented, or as part of a state or national public consultation) aiming to improve diets by targeting the food environments, and published between 2010 and 2020, across 14 databases in November 2020. Records were uploaded to the Evidence for Policy and Practice Information-Reviewer Web for the removal of duplicates, screening, as well as part of the data extractions for the different reviews of the series. About 12% of titles and abstracts and 33% of full texts eligible for the overarching project were screened by at least two reviewers independently. The remainder were screened by one reviewer after reaching a 90% agreement rate, except for those excluded because they were not about real-world policy (all were checked by a second reviewer). Disagreements were discussed with a third reviewer.

Depending on the review, data were either extracted by one reviewer and checked by another or extracted by two independent reviewers. The specific methods and results for each review are presented in their respective chapters.

All papers included in one of the four effectiveness or cost-effectiveness reviews were independently critically appraised by two reviewers. The quality of evidence syntheses in the overview of reviews was appraised using the checklist by the Scottish Intercollegiate Guidelines Network. For the systematic reviews of PPP evaluations and of voluntary approaches, study quality was assessed using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies. The review of voluntary approaches included 10 single cross-sectional studies and 5 repeat cross-sectional studies, all about food items, advertising material and other non-human ‘participants’. The studies in the PPP review consisted of two single cross-sectional studies, nine repeat cross-sectional studies, one interrupted time series and five policy document analyses; five of which involved human participants. The quality of the cost-effectiveness analyses was assessed with Drummond’s 10-criteria checklist version 2015. For the policy process review, their contributions were moderated on the basis of three criteria: relevance, rigour and richness.

Data for the five reviews that used quantitative data were synthesised using narrative approaches since they were not suitable for statistical pooling techniques, such as meta-analysis. In the systematic reviews and overview of reviews about effectiveness, we also used an effect direction plot to represent the summary findings graphically. We had planned to use the Grading of Recommendations, Assessment, Development and Evaluation approach in the three reviews about effectiveness but did not for different reasons explained in the respective chapters. Data in the qualitative review about policy process were analysed using a thematic analysis.



## Results

**Literature search and screening for the overarching project:** A total of 38,209 records were retrieved from the databases; 27,887 remained after removing duplicates and had their title and abstract screened against the eligibility criteria. Of these, 1859 met the criteria and had their full text screened, resulting in 500 records included. In parallel, 72 additional full texts were retrieved by screening websites and reference lists. Of these, 33 met the eligibility criteria, contributing to a total of 533 publications: 483 reporting on primary research evaluations and 50 on evidence syntheses.

All 483 primary studies were included in the evidence map. All evidence syntheses were screened for inclusion in the overview of reviews. Of the 483 publications on primary research, all those assessing the effectiveness of PPPs ( $n = 18$ ) were considered for the systematic review on the latter, and all those assessing the cost-effectiveness of policies ( $n = 4$ ) were included in the systematic review on the latter. For the systematic review of the effectiveness of voluntary approaches by private actors, given the high number of potential primary studies ( $n = 186$ ), only those comparing outcomes between participants and non-participants (NP) in the policies and that were published in journals in the most recent 4 years (2017–20) were considered ( $n = 15$ ). Lastly, the review of policy process included both primary studies and evidence syntheses of both qualitative and mixed-methods design that assessed factors influencing policy development or implementation. Again, due to their high number ( $n = 87$ ), only those published in 2019 and 2020 were considered ( $n = 33$ ).

**Systematic evidence map:** We found imbalances across the 483 included studies, suggesting that policy evaluations are conducted and published inequitably across the world both in terms of quantity and quality. Though 70 countries were represented overall, 81% of publications focused on only 12 countries (USA, UK, Australia, Canada, Mexico, Brazil, Chile, France, Spain, Denmark, New Zealand and South Africa), and 30% included the USA. Few evaluations were found about Africa, Central and South Asia, and the Middle East. Inequities were also detected in the study designs, with the most quantitative robust methods mainly documenting the abovementioned 12 dominant countries. Few publications reported on PPPs ( $n = 31$ ), and only one assessed the development of voluntary policies led by the public and private sectors each. Using a generous interpretation of the PROGRESS-Plus equity dimensions, we found that not only 50% of publications assessing policy effectiveness did not compare outcomes by any equity domain, but that the proportion of those doing so has decreased over time. Age was the most frequently assessed dimension, while occupation, religion and culture, social capital and disability were barely considered.

**Overview of reviews:** An overview of reviews of 11 systematic reviews was conducted to review the effectiveness of policies by governance approach. Three additional systematic reviews were considered for addressing questions about equity. The 11 systematic reviews primarily assessed regulatory policies (especially taxation) and a few voluntary approaches by the public sector, food retailers and restaurant chains. No PPP was included, and few regulatory and voluntary initiatives could be directly compared. Overall, the results suggest that, except for salt-related taxes, most regulatory approaches designed to improve health, consumer behaviour (e.g. food intake, purchases), and food environment outcomes were effective. These mainly consisted of trans-fat bans, taxes on sugar-sweetened beverages (SSBs) and non-essential foods (except for salt intake), and front-of-pack labelling (FOPL). Effects for voluntary approaches by public and private actors were also generally positive for salt and trans-fat reformulation (but regulatory trans-fat bans were more promising), labelling on products and supermarket shelves, and changing defaults in children's menus in restaurants, although some of them relied on single cross-sectional studies in the USA. Results for voluntary menu labelling and multicomponent commitments by large retail chains were mixed. The findings by PROGRESS-Plus categories indicate a lack of reporting of outcomes in systematic reviews for population groups that are prone to health inequalities: overall, evidence on equity is patchy, incomplete, mainly inconsistent and largely relies on single studies (although some evaluations had large samples) rather than aggregated bodies of evidence.

**Review of PPPs:** This systematic review aimed to complement the overview of reviews by assessing the effectiveness of PPPs targeting the food environment since the overview of reviews did not include data on the latter. We reviewed 17 studies evaluating seven PPPs to improve population diets and food environments. Five involved humans or data about human behaviours (sales and purchases) using cross-sectional design (single or repeat) or intermittent time series, seven assessed food products or labelling practices (all single and repeat cross-sectional), and five examined policy content and progress using documents. Overall, studies found that partnerships with the food industry to improve diets via reformulation or other changes to the environment have limited effect at achieving this aim.

**Review of voluntary approaches by private actors:** This systematic review aimed to complement the overview of reviews by assessing the effectiveness of voluntary approaches by private actors between participants and NPs. Sixteen studies evaluating nine voluntary approaches were included. Policies were mainly about advertising and marketing control, reformulation, and the retail and catering sectors. All were cross-sectional: nine single and seven post–post. All measured effects or associations on the food environment, such as product or advertising characteristics using cross-sectional designs. None evaluated humans. When comparing the commitment's participants to NPs, the direction of effect or of association for most outcomes was either inconclusive or worse for participants. There is no evidence to suggest that policies designed as voluntary approaches led by commercial actors are effective at reducing advertising and other promotion of unhealthy products to children, improving the nutritional composition of food and beverages, encouraging calorie menu labelling in chain restaurants, or reducing marketing targeting children on food packages.

**Review of cost-effectiveness:** Four studies of the cost-effectiveness of real-world policies to promote healthy diets were identified. Two studies suggested positive impacts for the fiscal measure of the Mexican SSB tax, and one for the voluntary government-led Health Star Rating FOPL intervention in Australia. The fourth one showed a lack of effectiveness and cost–benefit for the PPP intervention to reduce salt consumption in England as part of the Public Health Responsibility Deal. There is a pressing need to build on the extensive literature on the effectiveness of interventions with high-quality evidence on cost-effectiveness, to support meaningful action to tackle the scourge of diet-related ill health.

**Review of the policy process:** We included 33 papers studying the policy process (factors shaping from design to implementation) of regulatory, voluntary and PPP approaches. The studies on regulatory policy processes highlighted key enabling factors, including clear leadership; policy entrepreneurs, champions and strategists; policy supporters' coalitions; the active use of best evidence and local expertise; institutional and financial capacity; and harnessing focusing events. They also pointed to impeding factors, including practical considerations often around policy implementation and the generation of context-specific evidence; differing ideological positions; capacity constraints; the role of evidence; lack of key stakeholder engagement, and the deployment by the food and beverage industry of frames and framing strategies to ultimately oppose a policy process. This review also advanced the understanding of phenomena and mechanisms underpinning the policy process for improving diet, in particular how large food and beverage industries have become legitimate actors in policy interventions to improve diets.

## Conclusion

To our knowledge, this is the first review of real-world evaluations of policies to improve food environments. From the available evidence reviewed, regulatory appears to be the most effective approach, and voluntary industry approaches and PPPs have limited effectiveness. The geographic imbalance in the evidence and inadequate representation of equity dimensions across the policy evaluations should be redressed. Food policy should be designed and driven by the evidence of greatest effectiveness to improve food environments for healthier diets. The role and interests of policy stakeholders, and the accepted legitimacy of corporate actors in food policy, should be critically interrogated with healthy diets for the population as the first priority.

## Implications for future work

Implications for public health policy include prioritising structural changes through regulation as they are found to be the most effective approach to improve the food environment; expanding geographical representation of the evidence, capturing dimensions of health equity as policy outcomes; taking a systems approach across policies to improve food environments. Implications for future policy evaluations include developing guidance for appraising risk of bias and quality of non-clinical studies and for reporting policy characteristics in evaluations. Implications for future research and research funding include conducting studies on the role of corporate actors in food policy, conducting evaluations of real-world policies equitably across geographic regions, capturing equity dimensions in policy evaluations, and developing guidelines for quality and risk of bias of policy evaluations.

## Study registration

This study is registered as PROSPERO CRD42020170963.

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# Chapter 1 Background

## Description of the problem

This study synthesises the evidence on effectiveness and cost-effectiveness of population interventions to improve diet, as well as understanding policy processes, with a view to informing the most effective responses to unhealthy diets in England. This report details the systematic review of different types (regulatory, voluntary or partnerships) of population interventions to improve diet, and examines effectiveness, cost-effectiveness, and a range of factors influencing effectiveness.

It is difficult to overstate the role that unhealthy diet plays in human ill health, made worse by a strong social gradient in access to healthy foods and in diet-related diseases.<sup>1</sup> Poor diet is now estimated to be responsible for more deaths than any other risk globally.<sup>2</sup> This is also true for England, with diet driving the major chronic diseases currently faced by the population, estimated to be the largest contributor to overall disease and to have the highest impact on the NHS budget.<sup>3,4</sup> Obesity continues to be one of the most challenging long-term population health problems across England, experienced by both adults and children,<sup>5,6</sup> and felt more acutely in areas of greater deprivation.<sup>7</sup> Much of this is because high fat, sugar and/or salt (HFSS) foods are often inexpensive, easily accessible, highly promoted and therefore highly consumed. Most of the salt consumed by the English population is already in the foods people purchase.<sup>8</sup> The consumption of free sugars by adults accounts for 16–17% of their total energy intake<sup>9</sup> more than triple the 5% maximum recommended by the World Health Organization (WHO).<sup>9,10</sup> Intake of free sugars fails to meet the recommendations in all age groups, with unhealthy diet starting at a very young age. Children consume suboptimal fruit, vegetables and fibre and this worsens along the social gradient as with adults.<sup>9</sup> Poor diet during preschool years has been associated with poorer school attainment, and both dietary patterns and diet-related disease have been shown to track from childhood into adulthood.<sup>11</sup>

It is in this context that the English government is implementing a range of population interventions to promote diets, which aim to be health-promoting, support physical well-being, and reduce diet-related non-communicable diseases (NCDs), by reducing consumption of energy-dense, nutrient-poor foods, such as free sugars, salt, saturated and trans-fats, and increasing consumption of fruit and vegetables (FV), lean protein and other nutrient-dense foods. Several of these interventions aim to improve population diet by modifying food environments. According to the Food and Agriculture Organization, the food environment refers to food availability and physical access (proximity), economic access (affordability), the promotion, advertising and information about products and health (marketing and information), as well as food quality and safety.<sup>12</sup>

The interventions to improve food environments include **voluntary** reformulation programmes to reduce ingredients like sodium and sugars in foods, alongside **regulatory** policies, such as the Soft Drinks Industry Levy (SDIL) implemented in 2019. Indeed, population interventions to improve diet can be broadly categorised by 'governance' type: (1) **regulatory interventions** (public regulation with no involvement of private sector actors); (2) **public-private partnerships (PPPs)** (public and private sector organisations collaborate in the establishment of collective initiatives to improve health) and (3) **voluntary approaches** (whereby the private sector designs and monitors its own standards of conduct). Though all three types of interventions have demonstrated varying degrees of effectiveness and therefore potential, there are also risks and challenges to all, with studies indicating that they are not yet optimally designed and/or implemented to meet public health goals.<sup>13,14</sup> The authors' earlier work indicates that a population intervention to improve diet will be most successful if underpinned by clear accountability, monitoring and evaluation processes, as well as a stated public health objective and sufficient political will to sustain it in the face of resistance. Voluntary commitments and PPPs often lack in accountability and oversight mechanisms; moreover, they often do not include the most effective

interventions, or well-defined, evidence-based, quantitative targets, which push partners to go beyond 'business as usual' and require them to demonstrate progress against the targets, nor do they sufficiently involve the public in the development and monitoring of the interventions.<sup>15</sup>

Thus, this evidence synthesis assesses the evidence of effectiveness of such population interventions with a view to informing more effective responses to unhealthy diet in England, and with lessons and implications for the wider world. We reviewed the different types (mandatory, voluntary or partnerships) of population interventions to improve diet, and examine implementation, effectiveness, and cost-effectiveness, and factors influencing effectiveness.

### Description of the intervention

Over the past decade, the effectiveness of a range of population interventions to improve diet has been evaluated. Those with most long-term promise are those targeting upstream determinants of poor health, aiming to improve conditions and opportunities, so that the majority of the population can eat healthily. Population interventions can be driven by different types of actors and designed in various ways, ranging from regulatory interventions (where action is required by government and regulated by public authorities), to PPPs (collaborative efforts primarily between private industry and government actors but also including other actors), to voluntary approaches (which are industry-led and without involvement from the public sector). This evidence synthesis will assess the effectiveness of all three types of population interventions, and here below we look at each of these in turn.

**Voluntary approaches** entail actions by the private sector to create and/or enforce their own initiatives or rules, with no public involvement. Voluntary approaches have been shown to be effective when monitored by arms' length public health bodies. However, there are also risks and challenges to voluntary agreements, with studies indicating that in their current formats, voluntary agreements to improve diet are usually based on vague commitments, focused on easy but ineffective approaches (such as information sharing), and often hampered by limited monitoring and reporting, generating poor data.

**Public-private partnerships** Population interventions can be neither entirely regulatory nor voluntary, but with formalised agreements entailing a degree of oversight from a public body, such as a government department of health. These arrangements are most usually referred to as PPPs, involving public and private sector organisations (to varying degrees) in the establishment of collective initiatives to improve health. A PPP in health involves collective work between at least one private for-profit organisation with at least one public (not-for-profit) organisation to jointly share efforts and benefits, with a common commitment to a health outcome. PPPs can be a promising middle option between industry-led voluntary approaches, which are argued to lack sufficient oversight, and regulatory interventions, which can be effective but politically contentious. The rationale for PPPs is that health problems and their solutions should involve all key stakeholders, and that these mechanisms may be cheaper, quicker alternatives to introducing and monitoring legislation, and may help to harness the private sector's efficiency, cost-saving and expertise to help achieve public health nutrition goals. However, the fundamental purposes of being in PPPs may diverge significantly between the public and private sectors. For public sector partners, PPPs can be a way to supplement funding for research on diet. For private sector partners, PPPs open opportunities to promote their brand and image, and present themselves as legitimate actors in the policy-making processes. While PPPs have had some success in other fields, particularly in the field of environmental policy, some evaluations have shown limited positive impact of PPPs in diet improvement.

**A regulatory intervention** entails public regulation with no involvement of private actors other than as observers or contributors to consultations. It is an initiative, rule or action by government in which participation is required and there is public sector enforcement. Regulatory population interventions are considered the most effective at meeting objectives but may be politically or commercially unacceptable.

Regulatory attempts to reduce consumption of harmful commodities are often met with opposition from producers and marketers of those commodities, and those stakeholders have been shown to use common strategies in resisting the introduction of such upstream regulation.

## Reasons for conducting this review

To the best of our knowledge, this is the first comparison of evidence of effectiveness of voluntary, regulatory and partnership approaches to improving diet. It is also the first review that attempts to synthesise evidence to help us understand the theories that underpin these different approaches, and the implementation and monitoring issues that contribute to their impact.

In 2013, we conducted a scoping review of voluntary agreements and their success criteria. The scoping review was an important start but an incomplete exercise, in that it was not a comprehensive, systematic review, and it was not specifically focused on diet. Moreover, and crucially, it only reviewed the evidence of effectiveness of voluntary agreements. Finally, the review was published in 2013, and an update of the latest literature is now warranted.<sup>15</sup>

As noted below in the section on the size of the literature, other reviews exist on specific intervention types (e.g. voluntary agreements), and on the effectiveness of interventions to address specific aspects of the diet (e.g. comparisons between regulatory and voluntary approaches to reducing consumption of trans-fatty acids). However, we do not know of any review examining the evidence on the effectiveness of these different intervention approaches to improving diet through the same lens.

It was essential to understand how different policy instruments are meant to work in theory or practice. This evidence synthesis will lead to subcategorisations of approaches, which cut across different governance arrangements: for example, incentive-based mechanisms can be employed in mandatory or partnership arrangements, but be quite different in their construction, that is be driven by different actors and motivated by incentives of a different nature. For example, the SDIL establishes a clearly defined incentive to act (with manufacturers needing to reduce sugar in products by a certain date, at the risk of costing them a certain amount if this is not achieved); the Responsibility Deal (RD) was also an incentive-driven mechanism yet the parameters of that incentive were far less clearly outlined. Thus, we categorise interventions first in terms of governance arrangements to enable an understanding not only of impact of effectiveness, but also the implementation and monitoring issues that contribute to their impact. We believe this to be a major added value of the review. Governance is a key overlooked mechanism in these interventions and reviews of these interventions, and it is a key part of the context, which is rarely discussed. We are confident that studies identified in the systematic review will help to throw light on whether and how governance arrangements have an impact on effectiveness, by understanding what factors relating to interventions, providers, populations and settings affect implementation of such population interventions to improve diet.

Given the range of population interventions to improve diet in England, and the urgent need to resolve the disease burden related to unhealthy diet, it is now essential to understand the effectiveness of different arrangements, levels and types of involvement of the public and/or private sector in improving diet, and what we can learn from the literature about how these could be made more effective at improving diet in England.

## Research aims and questions

### Aims

To search systematically for, appraise the quality of and synthesise evidence on the effectiveness, cost-effectiveness and policy process of population interventions to improve diet, including regulatory

interventions, voluntary approaches and PPPs, and to share the evidence synthesis, and formulate recommendations to improve interventions, with stakeholders with a view to informing more effective responses to unhealthy diet in England.

### *Research questions*

1. How are regulatory interventions, voluntary approaches and PPPs to improve diet assumed to work in theory?
2. What regulatory interventions, voluntary approaches and PPPs to improve diet, and reduce inequalities in diet improvement, have been evaluated?
3. What factors relating to interventions, providers, populations and settings affect implementation of such population interventions to improve diet?
4. Have such population interventions improved process, impact (intermediate and distal) and cost outcomes?
5. Are there any reported unanticipated effects of such population interventions?
6. What is the cost-effectiveness of such population interventions?
7. How can the findings of the evidence review be translated into recommendations for improved interventions?



## Chapter 2 Overarching methods

This chapter describes the overarching study design and methods for the series of evidence syntheses, including approaches to the literature search, data extraction and analysis, and a description of the individual evidence syntheses.

### Research design overview

This project consists of six distinct evidence syntheses ([Table 1](#)) of real-world evaluations of policies aiming to improve population diets by targeting the food environments, published between 2010 and 2020, all of which draw on a common systematic literature search strategy. They consisted of a systematic evidence map of primary research (see [Chapter 3](#)), an overview of reviews of the effectiveness of regulatory, voluntary and PPP approaches (see [Chapter 4](#)), two systematic reviews of the effectiveness of PPPs (see [Chapter 5](#)), and voluntary approaches by private actors (see [Chapter 6](#)), a systematic review of the cost-effectiveness of regulatory, voluntary and PPP approaches (see [Chapter 7](#)), and a qualitative review of policy process (see [Chapter 8](#)).

**TABLE 1** Summary of review outputs

Individual outputs	Relevance to research questions and objectives	Report chapter
Systematic evidence map of regulatory, voluntary and PPP approaches aiming to improve food environments.	Research question 2 <b>Objectives:</b> (1) To map global evidence reports on the breadth, purpose and extent of primary research evaluating the development, implementation, effectiveness and cost-effectiveness of regulatory, voluntary and PPP diet-related policies from both a policy and evaluation perspective; (2) To inform the next stages of the review.	<a href="#">Chapter 3</a>
Overview of reviews on the effectiveness of regulatory, voluntary and PPP policies to improve food environments.	Research questions 3, 4, 5 <b>Objective:</b> (1) To assess the effectiveness of regulatory, voluntary and PPP diet-related policies; (2) To document how these policies may work (mechanisms of action).	<a href="#">Chapter 4</a>
Systematic review on the effectiveness of PPPs to improve the food environments.	Research questions 4, 5 <b>Objective:</b> To compare the effectiveness of PPPs targeting the food environment.	<a href="#">Chapter 5</a>
Systematic review on the effectiveness of voluntary approaches by commercial actors to improve food environments.	Research questions 4, 5 <b>Objective:</b> To compare the effectiveness of voluntary approaches by commercial actors to improve food environments between participants and non-participants, including compliance to the policy guidelines and effects on the food environment, dietary intake and health.	<a href="#">Chapter 6</a>
Systematic review on the cost-effectiveness of policies to improve food environments.	Research questions 5, 6 <b>Objectives:</b> (1) To assess the cost-effectiveness of regulatory, voluntary and PPP diet-related policies; (2) To identify factors that make some interventions more cost-effective than others.	<a href="#">Chapter 7</a>
Qualitative systematic review of policy process in regulatory, voluntary and PPP approaches to improve food environments.	Research questions 1, 3, 5 <b>Objectives:</b> (1) To assess factors shaping regulatory, voluntary and PPP diet-related policies, from design to implementation; (2) To advance our understanding of phenomena and mechanisms underpinning the policy process for improving diet, in particular how large food and beverage industries have become legitimate actors in policy interventions to improve diets.	<a href="#">Chapter 8</a>
Discussion and conclusions.	Research question 7 <b>Objective:</b> To integrate the findings and propose recommendations.	<a href="#">Chapter 9</a>

## Eligibility criteria

This series of reviews focuses on ‘real-world’ studies published between 2010 and 2020 and assessing policies promoting healthy food environments. The year of 2010 was chosen for pragmatic reasons: it allowed us to cover the most recent decade fully while limiting the number of records to deal with given the particularly wide scope of topics searched. By food environment, we refer to food availability and physical access (proximity), economic access (affordability), and the promotion, advertising and information about products and health (marketing and information) as defined by the Food and Agriculture Organization,<sup>12</sup> with some exceptions listed in [Table 2](#), and we did not consider food quality and safety neither as a topic nor an outcome. Policies had to target the general public, for example, those focusing on athletes, the army, workplaces and other specific groups were excluded. No restriction on language and country was applied. To be considered ‘real-world’, data had to be collected either at least once when the policy was adopted or implemented, or as part of a state or national public consultation. Experiments, simulations and projections were therefore ineligible, unless they were based on ‘real-world’ policy data. Both policies and evaluations had to be conducted at the international, national, or state level. However, assuming that the characteristics of food and drinks offered in supermarket chains or advertised on major TV channels are similar across a region or country, audits of food products, shops and TV adverts could be conducted at any level unless the evaluation specified that they focused on local independent companies or channels.

**TABLE 2** Summary of eligibility criteria

Exclusion code	Included	Excluded
EX 1: Publication date	Between 2010 and 2020	Before 2010 and after 2020
EX 2–3: - Not diet - Not food environment - Excluded food environment topics	<p>Policies that ...</p> <ul style="list-style-type: none"> <li>- Apply to ‘ordinary’ food, including baby formulas, for example as per the Eatwell guide (NHS 2019)</li> </ul> <p><b>AND</b></p> <ul style="list-style-type: none"> <li>- Aim to promote healthy food environments (food proximity, affordability, marketing and information).</li> </ul>	<ul style="list-style-type: none"> <li>• Not diet-related</li> <li>• Not targeting ordinary food, for example ‘natural’ products, supplements, alcohol, functional foods, gluten free, GMOs</li> <li>• Breastfeeding</li> <li>• Not the food environment, for example education, clinical intervention</li> <li>• Health claims, food fortification, trade, markets’ regulation</li> <li>• Taxes not specific to food (e.g. on sales or income)</li> <li>• Food safety, hygiene, allergies, accuracy of nutrition values on labels, energy drinks interacting with alcohol or caffeine</li> <li>- Agriculture and farming as a primary focus</li> <li>- Food security, undernutrition, double/triple burden of malnutrition but <b>INCLUDE free school meals considered from a school food environment perspective</b></li> <li>- Food sustainability as a primary focus</li> <li>- About research collaboration as a topic</li> <li>- Historic research.</li> </ul>
EX 4: Not general population	<p>The policies aim to improve the health of the general public, including</p> <ul style="list-style-type: none"> <li>- Those in workplaces accessible to all, e.g. clients in a restaurant, visitors in a hospital canteen</li> <li>- Children in schools and nurseries.</li> </ul>	<p>The policy only targets</p> <ul style="list-style-type: none"> <li>- Staff in a workplace</li> <li>- Patients or people with specific health conditions</li> <li>- Athletes</li> <li>- The army.</li> </ul>
EX 5: Not real-life policy	<p>Includes data collected</p> <ul style="list-style-type: none"> <li>• Once the policy was adopted or implemented or</li> <li>• as part of a state or national public consultation.</li> </ul>	<ul style="list-style-type: none"> <li>- Experiments in non-real-life environments</li> <li>- Study of data collected only before the policy was adopted or implemented or testing policy scenarios</li> <li>- Research initiatives, for example testing an approach that is not part of a state/national/international policy</li> </ul>

TABLE 2 Summary of eligibility criteria (continued)

Exclusion code	Included	Excluded
	Experiments, simulations and projections are included when based on 'real-world' policy data defined as above.	- Evidence syntheses and comparative studies that have a great proportion of policies not meeting this criterion and that do not have subgroup analyses excluding them.
EX 6: Local POLICIES	Policies implemented at the <ul style="list-style-type: none"> <li>- International level</li> <li>- National level</li> <li>- Provincial/state level.</li> </ul>	- Policies implemented at a lower level than the state - Evidence syntheses and comparative studies that have a great proportion of policies not meeting this criterion and that do not have subgroup analyses excluding them.
EX 7: Local EVALUATIONS	Evaluations conducted: <ul style="list-style-type: none"> <li>- At a state, national or international level</li> <li>- Not state level but represents a big part of a country or multiple places across a country or state</li> <li>- Audits of food products, shops and TV adverts unless they specify they are local independent stores or TV channels.</li> </ul>	- Evaluations conducted at a lower level than state - Sample is too small to represent a country or state, for example two schools - Evidence syntheses and comparative studies that have a great proportion of policies not meeting this criterion and that do not have subgroup analyses excluding them.
EX 8: Not evaluation	- Primary research evaluations - Evidence syntheses that have searched at least two databases, mention eligibility criteria, AND clearly indicate which studies are included.	- Other literature reviews - Theoretical papers, commentaries, viewpoints, editorials, letters, conference abstracts, dissertations, theses - Study protocols, working papers, pre-prints - Websites, blogs, podcasts, book reviews, book chapters.
EX 9: Policy mapping	Studies assessing effectiveness, cost-effectiveness, factors influencing policy development or implementation (including how a policy was covered in media), responses to public consultations.	Studies solely inventorying ("mapping") the presence of policies in countries or regions and/or benchmarking their implementation.
EX 10: Views of the general public	- Studies assessing views of the general public as part of a state or national public consultation - Studies assessing views of the general public in the UK.	- Other studies or parts of studies assessing views of the public, <b>except in the UK which are INCLUDED</b> - Evidence syntheses and comparative studies that have a great proportion of policies not meeting this criterion and that do not have subgroup analyses excluding them.
EX 11: Insufficient focus on governance	- Primary research assessing multiple policies, that indicate at least broadly their governance, and analyse it - Evidence syntheses that analyse policies taking their governance approach into account.	Primary research and evidence syntheses of multiple policies that either have unclear governance or do not consider the governance approach in their analysis.
EX 12: Overviews of reviews	- Primary research evaluations - Evidence syntheses of mainly primary studies.	Overview of reviews (also called umbrella reviews) and other types of evidence syntheses of literature reviews.
EX 13 - UK local level and views of the public	(This was simply to group the following studies about the UK together) <ul style="list-style-type: none"> <li>- Those not focusing on local policies or evaluations (EX 6–7)</li> <li>- Those not assessing the views of the general public outside public consultations (EX 10)</li> <li>- Evidence syntheses mainly including studies about the two points above.</li> </ul>	
Duplicate	Documents that are not identical.	Identical documents (only keep one of them).

GMO, genetically modified organism.

**Note**

This coding tool was used in the order presented, for example, studies had to pass criterion EX 1 to be assessed for EX 2.

In addition to primary studies, evidence syntheses other than overview of reviews (also called umbrella reviews) were included if they (1) involved a search in at least two bibliographic databases, (2) mentioned the eligibility criteria (3) clearly indicated which studies were included (e.g. in a table or with a series of references at the start of the results section or within each subsection without needing to track down each reference to recreate a full list of included studies manually). Protocols, working papers, dissertations and pre-prints were excluded. Studies and sections of studies assessing the views of the general public outside public consultations were also not considered, as well as studies solely inventorying ('mapping') policies or benchmarking their implementation.

Lastly, given the focus of this project on governance, primary research and evidence syntheses of multiple policies that either have unclear governance or do not consider the governance approach in their analysis were excluded. The eligibility criteria are summarised in [Table 2](#) and detailed in [Appendix 1](#) (see [Table 24](#)). Note that the criteria were followed in order – that is the papers had to meet criterion 1 before being assessed for criterion 2.

### Search strategy

Fourteen databases were searched in November 2020: ABI/INFORM Global, Campbell Collaboration, Cochrane Library, EconLit, EMBASE, Epistemonikos, MEDLINE, PsycInfo, Science Citation Index Expanded, Social Sciences Citation Index, Arts and Humanities Citation Index, Conference Proceedings Citation Index-Science, Conference Proceedings Citation Index-Social Science and Humanities, and Emerging Sources Citation Index. Given the focus of the overarching project on policy governance approaches (i.e. whether policies are regulatory, voluntary or PPPs), the search was structured around the three following 'blocks' of terms using various free text and controlled vocabulary for each of them: (regulatory OR PPP OR voluntary) AND policy AND diet. Considering that some terms refer to several of these concepts at once (e.g. taxes are both a policy and generally regulatory), eight different Boolean phrases were conducted and combined at the end (see [Appendix 1, Table 24](#)). The search strategy in MEDLINE was tested on a sample of 38 publications that had been identified as potential studies in our funding application (see [Appendix 1, Table 24](#)) and was peer-reviewed by a librarian using the Peer Review of Electronic Search Strategies (PRESS) statement. Additionally, we screened the publication lists on the NOURISHING database (<https://policydatabase.wcrf.org/>) and the Global Food Research Program websites ([www.globalfoodresearchprogram.org/](http://www.globalfoodresearchprogram.org/)); as well as the reference lists of the overviews of reviews retrieved; studies in the systematic reviews of voluntary policy commitments by private actors and of cost-effectiveness, and studies in the evidence syntheses about cost-effectiveness excluded from the overview of reviews.

### Data management and screening

Records were uploaded to the Evidence for Policy and Practice Information (EPPI)-Reviewer Web (EPPI-Centre, University College London, UK) for the removal of duplicates, screening, as well as part of the data extractions for the different reviews of the series. Using the eligibility criteria outlined above, a first screening was performed for the overarching project. On top of this, additional screening was performed for each review according to their additional specific eligibility criteria. Details are specified in the methods section of each review. For the overarching project, at least 12% ( $n = 3346$ ) of titles and abstracts and 33% ( $n = 637$ ) of eligible full texts were screened by at least two reviewers independently (SR, LB, MJVS, CK, CL). The remaining were screened by one reviewer after reaching a 90% agreement rate. The records excluded because they were 'not a policy' were all checked by a second reviewer since disagreements were more common for that criterion. Disagreements were discussed with a third reviewer.

## Outputs of literature search

We retrieved 38,209 records from the databases; 27,887 remained after removing duplicates and had their title and abstract screened against the eligibility criteria. Of these, 1859 met the criteria and had their full text screened, resulting in 500 records being included. In parallel, 72 additional full texts were retrieved by screening websites, and reference lists. Of these, 33 met the eligibility criteria, contributing to a total of 533 publications: 483 reporting on primary research evaluations and 50 on evidence syntheses. These became the starting point of all six evidence syntheses. The detail of the selection process for the whole series of reviews is illustrated in [Figure 1](#). The processes and results for each review according to their specific eligibility criteria are presented in the results sections of their respective chapters.

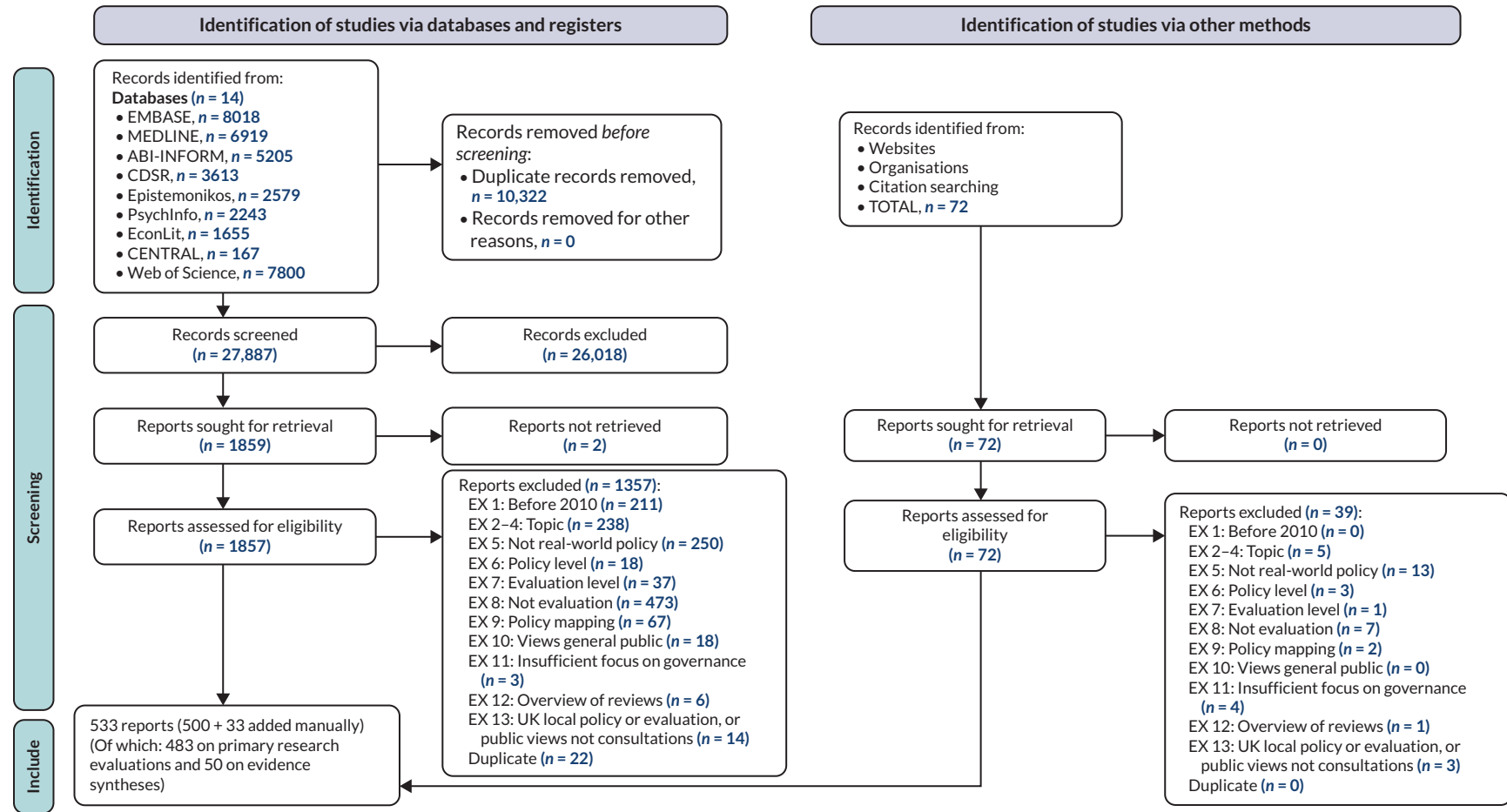
## Review outputs' relationships

[Figure 2](#) illustrates how the different review outputs are related along with the number of studies they include. As explained in [Chapter 3](#), for the systematic evidence map of primary research, given its size, we did link publications reporting on the same studies. Thus, numbers for this output represent publications, not studies. All publications retrieved on primary studies were included in the systematic evidence map, while further screening was applied on the evidence syntheses found for the overview of reviews. Some primary studies and evidence syntheses were also included in additional evidence syntheses specific to a governance approach (e.g. PPP) or study aim (e.g. cost-effectiveness). The systematic reviews in [Chapters 5](#) and [6](#) addressed gaps in the overview of reviews (see [Chapter 4](#)). All evidence syntheses contributed to a systems map.

## Data extraction

General policy and evaluation characteristics were extracted for all primary studies in the EPPI-Reviewer Web by one reviewer and checked by another (LB, SR, CL). There was one exception: the specific study designs of quantitative studies were extracted by one reviewer (LB) and 10% were checked by a second reviewer (CL), although study designs of studies included in [Chapters 5–7](#) were all further checked by two reviewers separately. Information extraction for each specific review is detailed in their respective chapters. Information was taken at face value unless otherwise specified. A third reviewer was involved to resolve disagreements.

The general policy characteristics extracted included the countries and World Bank regions, the name of the national and international policies (for pragmatic reasons, we did not identify the name of every state policy; instead we grouped them by topic and country regardless of the states), their policy level (international, national, state), the governance approach (regulatory, voluntary, PPP; inspired by a framework by Risse and Börzel<sup>17</sup>), and policy categories by adapting the 'NOURIS' part (which focuses on the food environment) of the NOURISHING framework:<sup>18</sup> N- Labelling (excluding health and nutrition claims); O-Specific settings, including schools, child care, health care and leisure; U-Economic tools (which was narrowed down to taxes and price reductions on healthy items); R-Advertising and marketing control; I-Product reformulation by manufacturers; I-Retail and food services environment (excluding those considered under 'O' and 'I'). Subcategories for each policy category were created iteratively. To limit 'policy noise', policies had to be the focus of the evaluation, for example, the European Union (EU) pledge (an advertising control policy in the EU) was only captured when specifically evaluated; not every time an advertising control policy was assessed in an EU country. The more we coded publications on governance, the blurrier the line became between voluntary policies and PPPs, and information on the actors involved was scarce. Thus, PPPs became a subcategory of voluntary policies and was joined with two new subcategories: (1) voluntary policies by the private sector (i.e. pledges and self-regulation, in which typically private organisations design their own initiative or their own criteria within an initiative),



**FIGURE 1** PRISMA flow chart representing the selection process for the entire review. Included Science Citation Index Expanded, Social Sciences Citation Index, Arts and Humanities Citation Index, Conference Proceedings Citation Index-Science, Conference Proceedings Citation Index-Social Science and Humanities, and Emerging Sources Citation Index. Adapted from the PRISMA template by Page *et al.* (2021).<sup>16</sup>

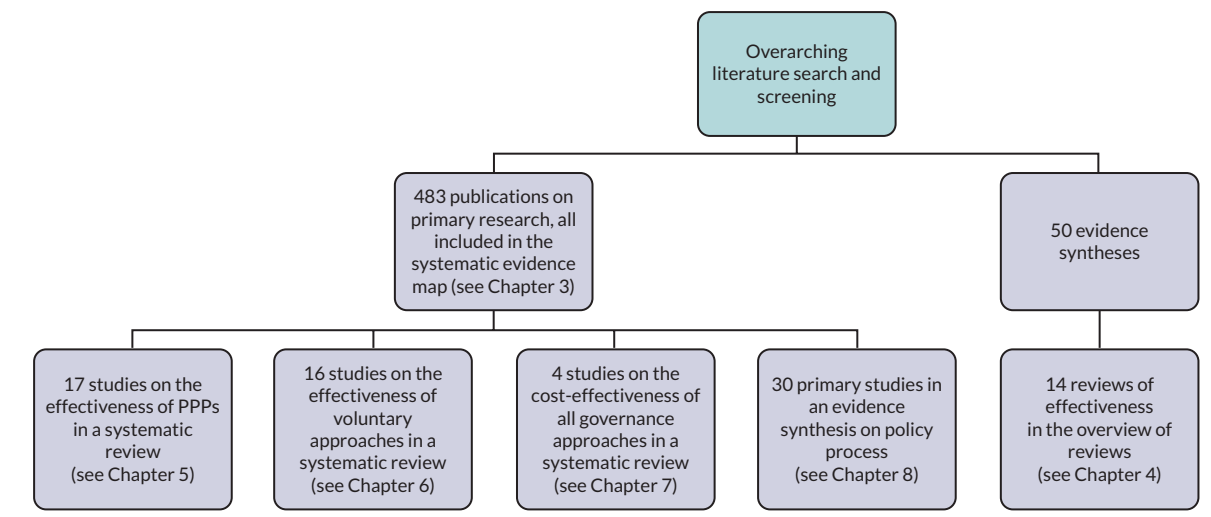


FIGURE 2 Relationships between review outputs.

and (2) voluntary policies by the public or not-for-profit sector. To be qualified as PPPs, policies had to be clearly identified as such or a collaboration between the public and private sectors.

Evaluation characteristics consisted of the publication date; general study aim (e.g. effectiveness, cost-effectiveness, implementation); study design including for quantitative studies the classification of natural experiments by Leatherdale (2019)<sup>19</sup> and the presence of a comparison group enabling comparison of either policies, policies versus absence of policies, or participants/products within a policy versus non-participants (NPs)/products; the types of participants and outcomes assessed; and in some of the reviews the health equity dimensions measured as policy outcomes.

The health equity dimensions examined were those from the PROGRESS-Plus framework,<sup>20</sup> which stands for Place, Race, Occupation, Gender, Religion and culture, Education, Socioeconomic status (SES) at the individual level, and Social capital. Age and disability were considered for the 'Plus'. In 'Place', in addition to place of residence we included where shops are located. In 'Age', we also considered comparisons between media and menus targeting children versus adults, between households with and without children, and data presented for baby and infant products separately. In 'Education', we also considered comparison of school characteristics, for example middle versus high schools. Deprivation indices that encompass a range of PROGRESS-Plus dimensions were coded as SES since they generally mostly refer to the latter overall. Health equity domains were searched in each publication by checking figures and tables and searching a list of keywords. A study was considered as exploring an equity dimension when it compared a policy outcome between different groups by the said dimension.

All data extraction categories were non-mutually exclusive, that is a publication could have more than one answer, except for study design.

## Study quality appraisal

All studies included in one of the four effectiveness and cost-effectiveness reviews were independently critically appraised by two reviewers (LB, SR, JB, GB, CL) using a tool according to their study design.

The quality of evidence syntheses in the overview of reviews was appraised using the checklist for systematic reviews and meta-analyses by the Scottish Intercollegiate Guidelines Network (SIGN) (see [Chapter 4](#) and [Appendix 3, Table 25](#), for more details).

For the systematic reviews of PPP evaluations (see [Chapter 5](#)) and of voluntary approaches (see [Chapter 5](#)), study quality was assessed using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies<sup>21</sup> (see [Appendix 4, Table 26](#)). The use of this tool represents a deviation from the protocol: it was planned to use Risk Of Bias In Non-randomised Studies of Interventions (ROBINS-I),<sup>22</sup> but the latter was discarded after trialling it on a few studies. The main challenge was that ROBINS-I was designed for follow-up (cohort) studies of interventions that are assumed to be planned or managed by researchers to some extent. This assumption did not apply well to the policy evaluations that we had, making the questions about cointerventions, classification of interventions and deviations from intended interventions difficult to judge meaningfully. We chose instead the Newcastle–Ottawa Scale, which has been widely used and allows identification of the main weaknesses of studies in a pragmatic manner. We selected a version for cross-sectional studies to match with the study designs included in the reviews. We developed additional guidance for studies of documents and environmental features (and one question focused on vaccines), which is lacking in most tools, and for providing an overall judgement given that the original tool uses a scoring system and this is now discouraged by Cochrane.<sup>23</sup>

Our modifications to the tool were tested in an iterative process, during which we conversed and agreed on the items and their interpretation. Like the original Newcastle–Ottawa Scale for cross-sectional studies, the final tool that we used included seven items grouped into three risk domains: (1) selection (including representativeness of sample, sample size, non-response/missing data, and ascertainment of the exposure), (2) comparability of subjects in different outcome groups on the basis of design or analysis and confounding factors controlled and (3) the assessment of the outcome and the statistical analysis. Each item was rated as having a high, moderate or low quality, or insufficient information to judge. The same categories were applied for the overall ratings. Studies that included at least one item rated ‘low’ were attributed an overall low quality. Studies attributed a moderate or unclear quality for the two key domains judged the most important – ascertainment of exposure and statistical tests – could only be rated ‘moderate’ or ‘unclear’ at best overall, respectively. Studies with more than one ‘unclear’ item were attributed an ‘unclear’ quality.

The quality of the cost-effectiveness analyses was assessed with Drummond’s 10-criteria checklist version 2015 (see [Chapter 7](#)), while the quality of the studies in the thematic synthesis (see [Chapter 8](#)) was appraised using the 10 questions for qualitative studies by the Critical Appraisal Skills Programme (CASP).<sup>24</sup>

## Data synthesis

This review in essence comprises a number of different reviews, the methods for which are described in respective chapters, and summarised here. The evidence map is descriptive (see [Chapter 3](#)), and so data were synthesised narratively using descriptive statistics, and visual maps were produced with EPPI-Mapper (EPPI-Centre, UCL, UK) and Excel. The four effectiveness and cost-effectiveness evidence syntheses (see [Chapters 4–7](#)) include quantitative findings, which, based on the initial scope (and confirmed by the subsequent review), were not suitable for statistical pooling techniques, such as meta-analysis. We synthesised findings by adapting narrative synthesis approaches in the three systematic reviews and overview of reviews of effectiveness (see [Chapters 5 and 6](#)).<sup>25</sup> For a graphical representation of the summary findings, in the two systematic reviews and the overview of reviews about effectiveness (see [Chapters 4–6](#)), we also used the effect direction plot developed by Thomson *et al.*<sup>26</sup> to represent graphically the summary findings. The effect direction plot displays non-standardised effects across the multiple outcome domains assessed in a review. Studies were grouped by policy and ordered by overall study quality, publication date and study design; with those considered to provide the best and most recent evidence listed first. According to Cochrane’s guidance and the revised guidance for the effect direction plot, the directions of effect are presented independently from statistical significance for domains of outcomes.<sup>26,27</sup> To mark an effect as being positive or negative, at least 70% of the outcomes within the category represented needed to point towards the same direction. When a study compared



multiple outcomes between participants and NPs, we split them into categories following those used by the study authors; this was for both increased transparency and for avoiding results to be inconsistent because a wide range of outcomes were considered together. The *p*-value of each outcome domain was not calculated due to important limitations in the methodology as explained elsewhere<sup>27</sup> (studies with conflicting or unclear effects cannot be included). Instead, we used the effect direction plot as a visual tool to present jointly the direction of effect, study quality and indirectness. As for the qualitative review (see [Chapter 8](#)), we employed a qualitative synthesis.

### ***Issues with the Grading of Recommendations, Assessment, Development and Evaluation approach***

In the three reviews assessing effectiveness (see [Chapters 4–6](#)), we had planned that the effect direction plots would have informed assessments with the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach.<sup>28</sup> However, the application of GRADE itself was not possible. In the overview of reviews (see [Chapter 4](#)), there were insufficient details in most of the systematic reviews to proceed. In the systematic reviews on private commitments and PPPs (see [Chapters 5 and 6](#)), the framework was judged unfit for purpose given the nature of the studies used, and this despite the modifications suggested in the protocol.

The GRADE framework helps determining the level of certainty in the evidence (rated as high, moderate, low, very low) for each outcome. Randomised controlled trials (RCTs) start at the highest certainty level (high) while observational studies start at 'low'. Certainty in the evidence is then rated down by considering the methodological limitations of the studies (risk of bias), indirectness (applicability and how it represents the research question elements), imprecision [number of events and confidence intervals (CIs)], inconsistency (heterogeneity in results) and likelihood of publication bias. Certainty can also be rated upwards, but this is an exception. As explained in the protocol, we believe that GRADE's hierarchy of evidence is inappropriate for policy evaluations. It does not reflect the best possible type of evidence that can realistically be obtained for a research question by considering both practical and ethical implications. Thus, in addition to RCTs, we had planned to also attribute a 'high' certainty to the following study designs at the start: (1) pre–post time-series analyses and (2) (potentially) cohorts/follow-up studies involving both a comparison group and data collected before and after policy implementation. Eligible comparisons included (1) comparing a policy to either another policy, the absence of a policy, or the same policy but in another location (e.g. different states or countries); (2) comparing participants in a voluntary policy to NPs; (3) comparing products or audience (e.g. TV audience) targeted by the policy to some not targeted by the policy.

However, these modifications did not address the problem. The main issues were that (1) the GRADE framework was developed for specific or narrow research questions while the review included a wide range of heterogeneous interventions and outcomes. The latter is common for policy topics since decision-makers are interested in a range of outcomes, and the policies from which we can learn can be quite different across settings and time. The assessment of publication biases and inconsistency were particularly problematic for this reason; (2) it does little to differentiate levels of certainty in evidence from observational studies. They all are rated as 'low' or 'very low', and this despite being the best sources that we can sometimes realistically obtain for some policy topics; (3) the exceptions of study designs outlined above were mostly inapplicable to the research questions of the studies included in the systematic reviews in [Chapters 5 and 6](#). Overall, given the nature of the research questions, we could only obtain 'low' or 'very low' statements no matter what the studies did. We felt that this led to the production of statements on the certainty of evidence that appeared absolute but were in fact uninformative at best, and misleading at worst. It could send the message to decision-makers that there is no good evidence, and that they might as well consider non-evidence-based sources, such as opinions, instead.

Regarding the exceptions outlined in the protocol (i.e. to also attribute a 'high' certainty at the start for pre–post time-series analyses and cohorts/follow-up studies involving both a comparison group

and data collected before and after policy implementation) (see [Appendix 2](#)), they were proven useless because most studies, including all those in [Chapter 6](#), sought to investigate whether a policy had led to improvements in the nutrient content, advertising content or labelling practices. These are outcomes of interest for policies aiming to improve food environments. However, these studies tend to be repeat cross-sectional, not cohort/follow-up studies. They compare the offer of products or adverts available at one point in time to that at another point in time. In this case, examining different products and adverts through time does not represent a methodological weakness. There were also a few document analyses investigating whether a policy was doing what it pretended or was on track. There is currently no guidance for the latter. To avoid producing statements of certainty of evidence that risk misleading decision-makers, a wider discussion about GRADE for policy evaluations in the systematic review community is needed.

# Chapter 3 Systematic evidence map of regulatory, voluntary and public–private partnership policies to improve food environments and population diet

## Introduction

This chapter reports the systematic evidence map of the included literature, which exposes regional differences in existing across geographical regions, as well as by equity dimension and governance approach.

## Evidence map methods

### *What is a systematic evidence map?*

Systematic evidence maps, also known as evidence gap maps, are a type of evidence synthesis and research translation tool that visually presents the breadth of research available on an area using a systematic approach. While they are generally used to produce high-level descriptions and identify gaps in evidence, we believe that they can also be employed from a critical perspective to question practices both in research and in the field.<sup>29</sup> In the present case, examining the characteristics of both the policies that have been evaluated, and of the evaluations themselves, can shed light on the body of evidence that countries have at their disposal to make decisions about policy design and effectiveness. Thus, this systematic map of global evidence reports on the breadth, purpose and extent of primary research evaluating the development, implementation, effectiveness and cost-effectiveness of regulatory, voluntary and PPP diet-related policies from both a policy and evaluation perspective.

### *Methods overview*

This systematic evidence map used the literature search, eligibility criteria, screening and data extraction strategies detailed in [Chapter 2](#). As a reminder, the data extracted consisted of (1) general policy characteristics, including countries and World Bank regions, policy names, policy levels, governance approaches and policy categories by adapting the 'NOURIS' part of the NOURISHING framework:<sup>18</sup> N- Labelling, O-Specific settings including schools, child care, health care and leisure, U-Economic tools (narrowed down to taxes and price reductions on healthy items), R-Advertising and marketing control, I-Product reformulation by manufacturers, I-Retail and food services environment; (2) evaluation characteristics, including publication date; general study aim, study design; and for studies assessing policy effectiveness, the types of participants and outcomes assessed and health equity dimensions measured using a generous interpretation of the PROGRESS-Plus framework,<sup>20</sup> which stands for Place, Race, Occupation, Gender, Religion and culture, Education, SES at the individual level, and Social capital as well as Age and Disability for the 'Plus'. A study was considered as exploring an equity dimension when it compared a policy outcome between different groups by the said dimension.

Data were synthesised narratively using descriptive statistics based on the data extraction categories. Visual maps were produced with EPPI-Mapper (EPPI-Centre, UCL, UK) and Excel.

## Findings

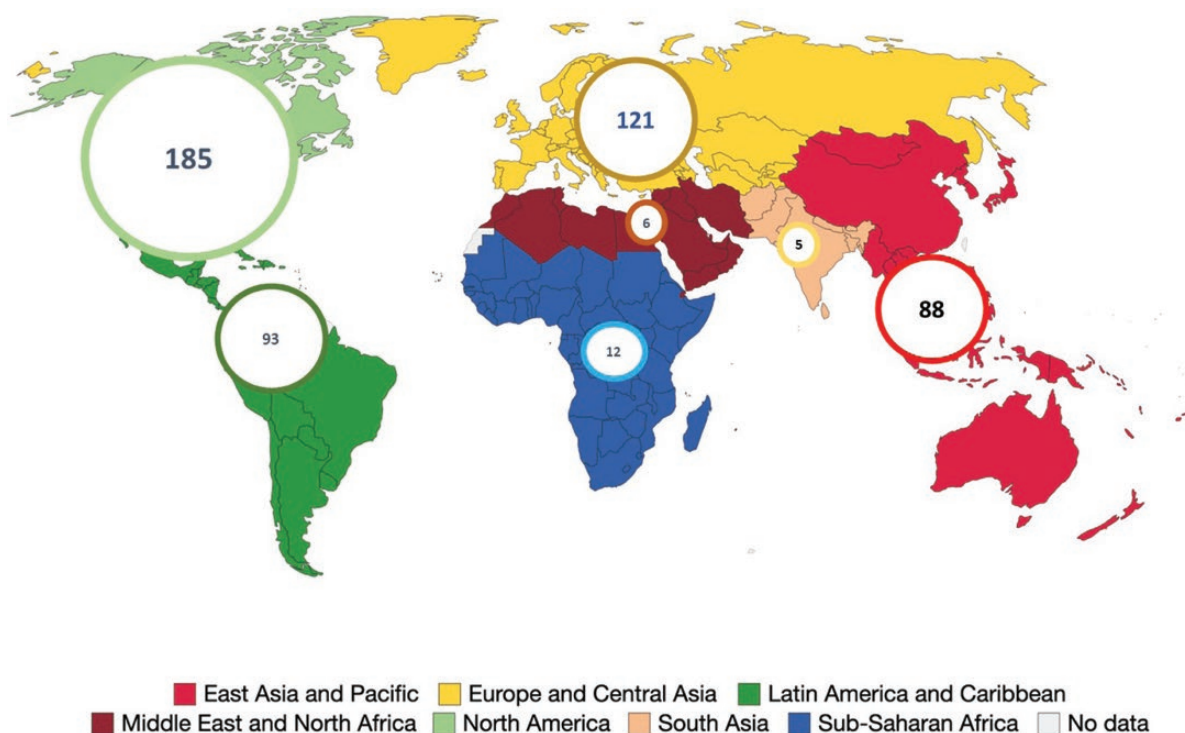
### Included and excluded studies

In addition to the 483 publications reporting on primary studies, the 15 excluded full texts reporting on UK local policies and/or evaluations (see [Report Supplementary Material 1, Table S1](#)) (which were part of the 15 UK publications excluded because they were either about the local level or views or the public at the state or national level) were set aside for further analyses. The characteristics of the 483 included publications are described in [Report Supplementary Material 2](#), while those on the local evaluations in the UK and on the excluded publications are listed in [Report Supplementary Material 1](#) (see [Table S2](#)). In accordance with Cochrane's guidance,<sup>30</sup> only the characteristics of the full texts excluded for the least apparent reasons are listed, that is because of their policy level (EX 6), evaluation level (EX 7), policy mapping (EX 9), views of the general public (EX 10), evidence synthesis not considering governance (EX 11), UK local policy or evaluation, or public views not consultations, or full texts not obtained ( $n = 172$ ).

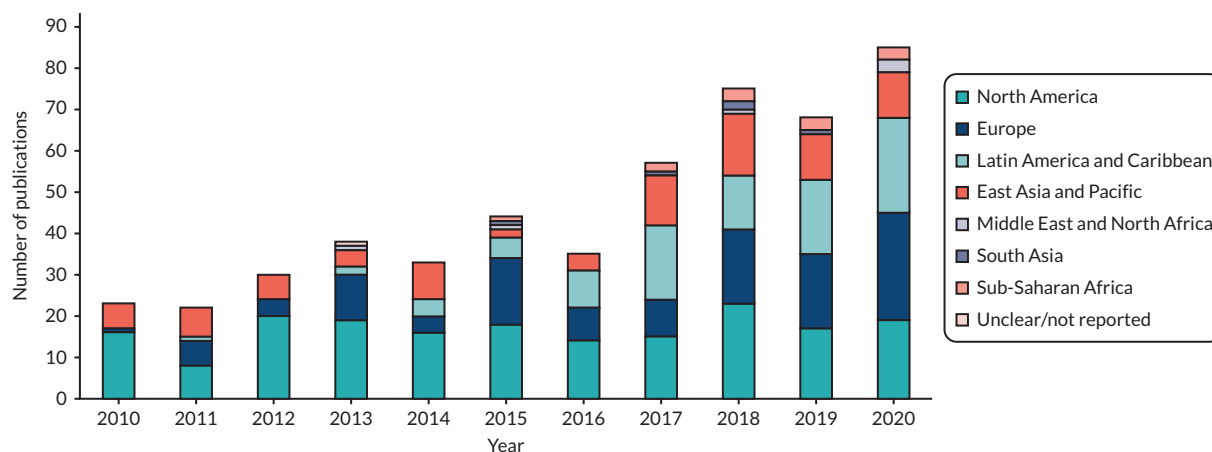
Given the size of this evidence synthesis, we did not attempt at this stage nor for the systematic evidence map of primary research to link publications reporting on the same studies. Thus, the number of 'includes' are publications, not studies.

### Regional differences across publications

Overall, 70 countries were documented. As shown in [Figure 3](#), there were apparent inequalities in coverage between countries and world regions. The number of evaluations published each year on eligible real-world policies has nearly quadrupled over 11 years, ranging from 23 in 2010 to 85 in 2020 ([Figure 4](#)). Studies examining North American countries (38% of publications overall) dominated throughout the period except in 2017 and 2020. The increase in publications worldwide was mainly driven by the World Bank regions of Europe and Central Asia, and of Latin American and the Caribbean (25% and 19% of total publications, respectively), although no Central Asian country was documented and only three studies assessed the Caribbean. East Asia and the Pacific were covered in 18% of total



**FIGURE 3** Number of publications by World Bank world region ( $n = 482$  because it is unclear in one publication). Note: the same publication can include more than one world region (non-mutually exclusive categories).



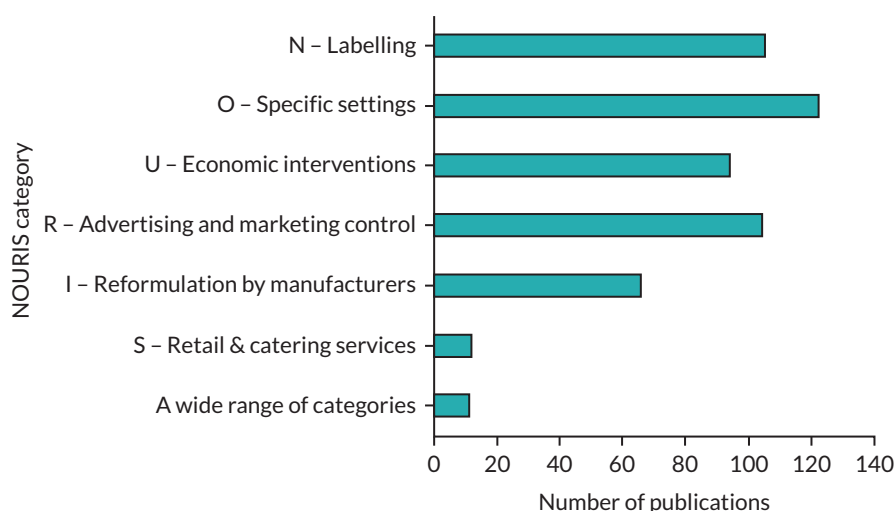
**FIGURE 4** Number of publications by world region and year ( $n = 483$ ). Note: since the same publication can include more than one world region (non-mutually exclusive categories), this graph does not reflect the actual total number of publications per year.

publications. Regarding countries, 30% ( $n = 146$ ) of publications included the USA, 11% ( $n = 54$ ) the UK, 11% ( $n = 51$ ) Australia, 8% ( $n = 41$ ) Canada, 8% ( $n = 40$ ) Mexico, 5% ( $n = 25$ ) Brazil, 4% ( $n = 19$ ) Chile, 3% ( $n = 14$ ) France and Spain each, 3% ( $n = 13$ ) Denmark, and 2% New Zealand and South Africa each ( $n = 12$  and  $n = 11$ , respectively). Eighty-one per cent ( $n = 390$ ) of publications considered these 12 countries alone (without any other country). By contrast, 32 countries were included in only 1 or 2 publications each. While some of these were high-income countries, disparities with and within the least-documented world regions was startling: 12 publications were found about Sub-Saharan Africa (all but 1 about South Africa), 6 about the Middle East and North Africa (4 of which about Saudi Arabia), and 5 about South Asia (all about India). Given that some of these evaluations included multiple countries, the level of details available for some of these countries was particularly limited. One publication had unclear countries and world regions because it assessed companies' stock markets.<sup>31</sup> Nearly all publications were in English ( $n = 417$ ), nine were in Spanish, two in Portuguese and one in French.

### Characteristics of policies assessed

The policies examined included 236 national policies (assessed in 73% of publications), 26 groups of state policies (assessed in 26% of publications) and 9 international policies (assessed in 6% of publications). One policy had both a national and a state component. All state policies were implemented in dominant countries (Australia, Brazil, Canada, Spain, the UK and the USA). The five most assessed policies consisted of American state school food standards ( $n = 37$ ), the Children's Food and Beverage Advertising Initiative (CFBAI; a national voluntary self-regulation advertising industry code in the USA,  $n = 21$ ), the Mexican tax on sugar-sweetened beverages (SSBs) (national,  $n = 19$ ), the UK SDIL (national,  $n = 14$ ), and various American state SSB taxes ( $n = 14$ ). Together, these three taxes represented 54% of publications about economic interventions (see below). The three most examined international policies were the Australasian Health Star Rating (HSR) (Australia and New Zealand,  $n = 11$ ), the EU Pledge ( $n = 5$ ) and the WHO Code of marketing breastmilk substitutes ( $n = 5$ ).

Using the six 'NOURIS' categories, as shown in [Figure 5](#), the most assessed policy categories were those specific to school, child care, health care and leisure settings (O,  $n = 122$ , 76% of which on schools), followed by labelling [N,  $n = 105$ , 39% of which about front-of-packs (FOPs)], advertising and marketing control (R,  $n = 104$ , 55% of which about television alone) and economic interventions (U,  $n = 94$ , 86% of which about SSB taxes). Evaluations of product reformulation by manufacturers were much less common (I,  $n = 66$ , 61% of which about salt) as well as those on the retail and catering sectors (S,  $n = 12$ , 83% of which at least aimed to increase the availability of healthy options). Eleven assessed policies that covered a wide range of NOURIS domains (these were grouped separately).

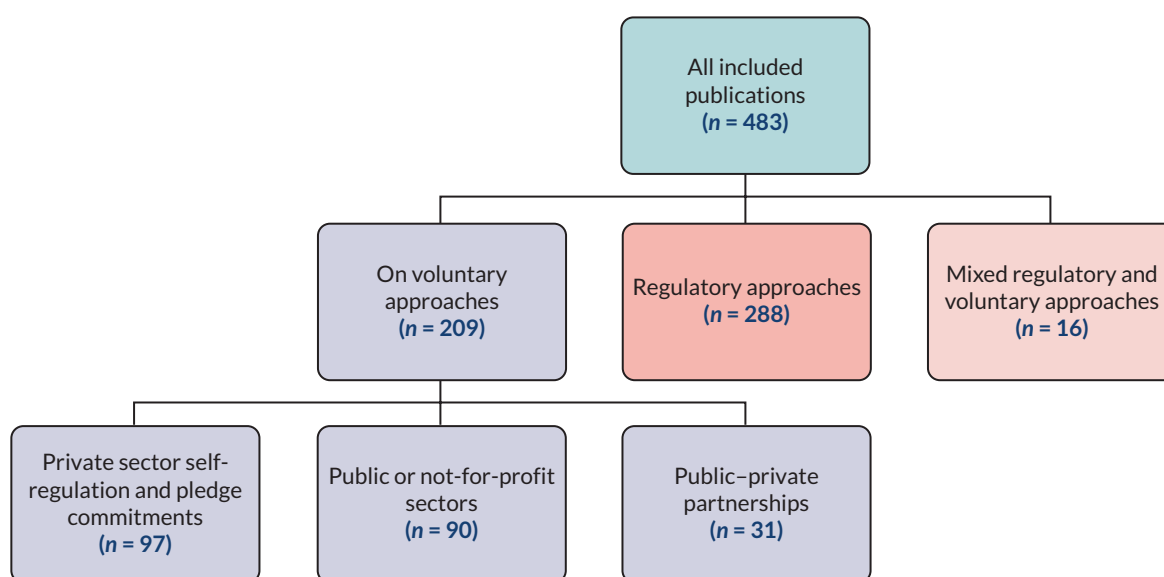


**FIGURE 5** Number of publications by Nouris category ( $n = 483$ ). Note: a publication can include more than one policy category (non-mutually exclusive).

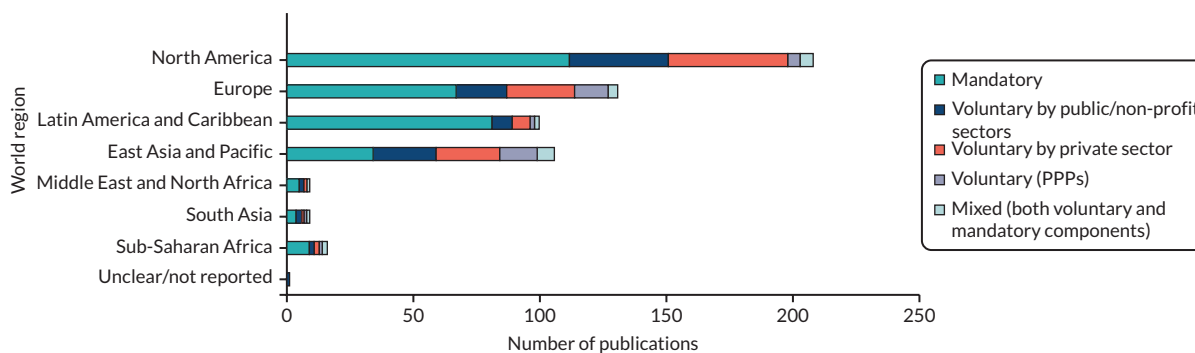
**Governance arrangements assessed**

Sixty per cent (60%,  $n = 288$ ) of publications reported on at least one regulatory initiative, 43% ( $n = 209$ ) on at least one voluntary action, and 16 assessed mixed governance policies (e.g. the combined use of regulatory labelling and voluntary limits for trans-fats in Canada) (Figure 6). Evaluations of voluntary policies mainly consisted of those led by the private sector (self-regulation and pledges,  $n = 97$ ) and actions by the public or not-for-profit sector ( $n = 90$ ), while a minority has investigated PPPs ( $n = 31$ ). Most publications on PPPs were about the RD in England, UK ( $n = 12$ ) or the Australian Food and Health Dialogue (FHD) and/or its updated version, the Healthy Food Partnership ( $n = 10$ ).

Figure 7 shows the distribution of publication by governance approach and world region. Regulatory approaches represent the majority of publications in all World Bank regions, ranging from 39% in East Asia and the Pacific to 87% in Latin America and Caribbean. East Asia and the Pacific is the region where governance approaches have been assessed the most evenly. Voluntary actions by the private sector were the second most assessed approach in North America and Europe, voluntary actions by the public and not-for-profit sectors were second in Latin America and Caribbean, the Middle-East and North



**FIGURE 6** Number of publications by governance mechanism ( $n = 483$ ). Note: a publication can include more than one governance approach (non-mutually exclusive categories).



**FIGURE 7** Number of publications by world region and governance approach ( $n = 483$ ). Note: a publication can include more than world region and governance approach (non-mutually exclusive categories).

Africa, and South Asia, and the two voluntary categories were equal in East Asia and Pacific and Sub-Saharan Africa, although the sample size in some regions is too small to draw conclusions. As highlighted previously, most PPP evaluations were conducted in Europe (especially the UK) and East Asia and Pacific (especially Australia). There were few evaluations of mixed approaches across all world regions.

When combining information on governance approach, world region and policy category together, evaluations about labelling (N) were mainly about regulatory initiatives in North America (especially menu labelling) and Latin America [especially front-of-pack labelling (FOPL)], followed by the voluntary FOP HSR in Australia and New Zealand. Most publications on specific settings (O) evaluated regulatory interventions in schools in North America, then in Europe. Evaluations of economic interventions (U) were mostly concentrated in Latin America, Europe, and the USA, most of which were regulatory since they were taxes. Publications on advertising and marketing control (R) were mainly in North America, followed by East Asia and Pacific and Europe, and were predominantly voluntary actions by the private sector in all three regions. In fact, 53% of evaluations of voluntary approaches by the private sector in this policy category consisted of the CFBAI in the USA; the CFBAI in Canada; the Publicidad, Actividad, Obesidad, Salud code in Spain; and both the Australian Responsible Children's Marketing and Australian Quick Service Restaurant Industry's Initiatives (QSRI). Evaluations of product reformulation (I) were about equally distributed across governance approaches in the four dominant world regions, with slightly more PPP evaluations in East Asia and Pacific. The few evaluations of policies targeting the retail and catering sectors or using a wide range of policy categories were only in North America, East Asia and Pacific and Europe, with various distributions of governance approaches. We formulated the hypothesis that evaluations of the least assessed world regions and countries focused on back-of-pack labelling, assuming that it might be the most frequently implemented policy given its simplicity and neutrality. This was not the case: the 18 evaluations covering Africa, the Middle East and South Asia documented a variety of policy areas, which were mainly regulatory (including five on SSB taxes). Similar conclusions were made for the 24 publications that included the 32 least evaluated countries (countries assessed once or twice, in any world region).

We explored whether similar trends applied for local policies and/or evaluations using the 15 publications that were excluded because they were about the local level in the UK. One focused on Scotland, another on Wales, and the rest on England. Together, they examined nine different policies in only two categories: specific settings (O,  $n = 8$ ; six regulatory about schools, two voluntary by the public sector in hospitals) and the retail and catering sector (S,  $n = 7$ ; three regulatory, two voluntary by the public sector, two voluntary by the private sector). The number is substantial given that only 12 publications were identified for that category in the whole evidence map. This potentially reflects the greater capacity to implement such initiatives at the local level, whereas other policies such as taxes and TV advertising control are easier to establish at a higher level. The local regulatory initiatives in the retail and catering sectors included planning regulations within the healthy weight strategy and takeaway planning restrictions. The voluntary approaches by the private sector consisted of the Change 4 Life

programme, the Healthy Catering Commitment in London, and self-regulated checkout policies by some supermarket chains.

### Study aims, participants and outcomes assessed

The vast majority of evaluations ( $n = 389$ , 81%) assessed the effectiveness of a policy, followed by factors affecting their implementation ( $n = 67$ , 14%), factors influencing their development ( $n = 34$ , 7%), how a policy was portrayed in the news ( $n = 11$ , 2%), responses to public consultations ( $n = 10$ , 2%) and cost-effectiveness analyses ( $n = 4$ , 1%). The remaining study investigated whether the New Zealand Advertising Standards Authority self-regulation code protects child rights. Only the fifth ( $n = 25$ ) of the 119 evaluations assessing other aspects than effectiveness covered other countries than the 12 dominant countries (i.e. USA, UK, Australia, Canada, Mexico, Brazil, Chile, France, Spain, Denmark, New Zealand and South Africa). Given that these types of studies aim generally to employ qualitative or mixed methods, unsurprisingly, the latter study designs were also mostly employed in these countries (as well as Fiji). [Figure 8](#) shows the number of publications by governance approach and study aim category. PPPs were those that were the most assessed holistically with 32% of publications assessing factors influencing implementation and 16% assessing policy development. They were followed by regulatory policies (12% on implementation, 9% on development, and representing most studies on media coverage and public consultations). By contrast, policies led by private actors (mainly self-regulations and pledges) were particularly underevaluated on these aspects with only 7% of publications on implementation and one evaluation of policy development.

Studies assessing effectiveness focused on a wide range of 'participants' or samples: out of 389 publications, 43% ( $n = 166$ ) relied on data collected data via humans only, 57% did not involve humans at all (i.e. they collected data directly on the environment, in the news or documents,  $n = 182$ ), and 11%

Policy governance approach Study aim (to assess ...)	Regulatory	Voluntary (any including mixed)	Voluntary by public or non-profit sectors	Voluntary by private sector	Voluntary PPP	Mixed (regulatory and voluntary)	Total
Effectiveness	231	183	73	87	18	12	389
Cost-effectiveness	2	2	1	0	1	0	4
Factors influencing policy development	25	9	1	1	5	2	34
Factors influencing policy implementation	34	39	23	7	10	2	67
How a policy was portrayed in the news	10	2	1	0	1	0	11
Responses in public consultations about a policy	8	2	1	1	0	1	10
Other	1	1	0	1	0	0	2
<b>Total</b>	<b>288</b>	<b>223</b>	<b>90</b>	<b>97</b>	<b>31</b>	<b>16</b>	<b>483</b>

**FIGURE 8** Number of publications by study aim category and governance approach ( $n = 483$ ). Note: a publication can include more than one study aim and governance approach (non-mutually exclusive categories). Dark green:  $\geq 100$  publications; pale green: 75–99; yellow: 50–74; red: 25–49; white:  $< 5$ .



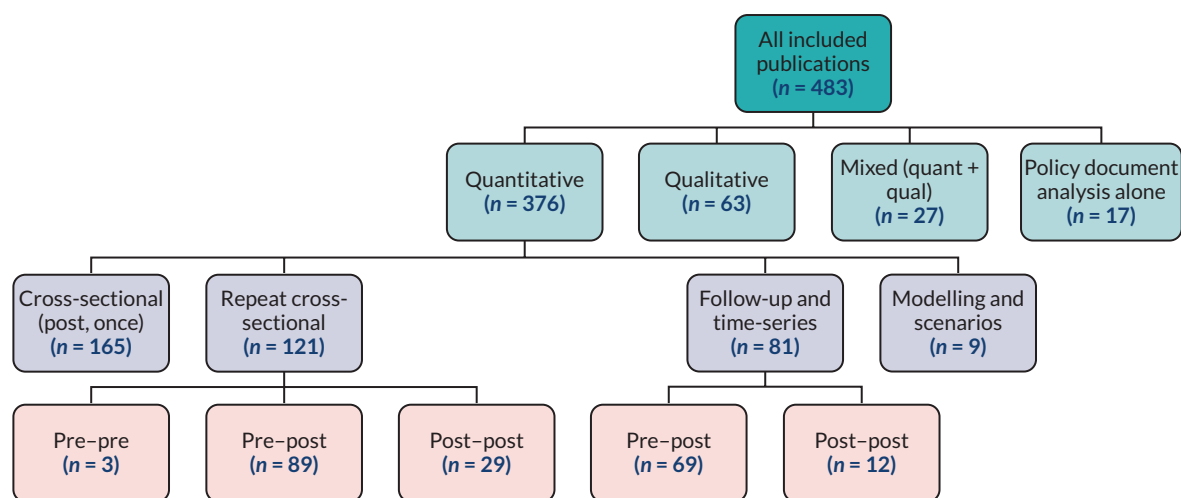
( $n = 41$ ) involved both. Consequently, the type of outcomes evaluated also varied. Nine per cent ( $n = 35$ ) have investigated health-related outcomes [e.g. mortality, diseases, disability-adjusted life-years (DALYs), nutritional status and anthropometric]; these were nearly all conducted in the USA, followed to a smaller extent by Denmark ( $n = 4$ ) and Portugal ( $n = 3$ ). The other types of outcomes considered included human behaviours (e.g. dietary intake, sales, purchases, advertising viewing and use of labels; 35%,  $n = 137$ ), environment features (66%,  $n = 256$ ), policy characteristics or implementation status (6%,  $n = 22$ ) and other outcomes (2%,  $n = 9$ ). All policy categories mainly assessed environment features except for U-Economic interventions, which mostly examined human behaviours.

### Study designs employed

As explained in [Chapter 2](#), study design was documented for all primary studies. The design of 67% ( $n = 254$ ) of quantitative studies was further extracted using the classification of natural experiments by Leatherdale<sup>19</sup> as well as presence of a comparison group enabling comparison of either policies, policies versus absence of policies, or participants/products within a policy versus NPs/products.

As described in [Figure 9](#) and more detailed in [Table 3](#), 78% ( $n = 376$ ) of publications employed a quantitative design, 13% ( $n = 63$ ) a qualitative method and a minority either used both (mixed methods; 6%,  $n = 27$ ) or analysed policy documents alone (4%,  $n = 17$ ). Among quantitative studies, most were single post cross-sectional studies (one data collection, 44%,  $n = 165$ ), followed by repeat cross-sectional studies (32%,  $n = 121$ ), follow-up and time series (22%,  $n = 81$ ), and modelling studies and scenarios ( $n = 9$ ). Note that the label 'follow-up studies' was only applied to human participants because non-human 'participants', such as products and adverts, are generally not the same through time. Pre-post studies ( $n = 160$ ) were more common than post-post ( $n = 41$ ). Three studies focused on the implementation phase alone (i.e. before the official policy implementation date).

[Table 3](#) shows the number of publications by study design for the whole map ( $n = 483$ ), for the publications only focusing on the 12 dominant countries ( $n = 390$ , 81% of the map), those focusing only on the USA ( $n = 141$ , 29% of the map) and those including other countries than the 12 ( $n = 93$ , 19% of the map). According to Leatherdale, the most robust natural experiments are those that include a control (or comparison) group, a pre-post design, as well as time series and follow-up studies.<sup>19</sup> The most used study designs in publications covering only the 12 dominating countries were single cross-sectional studies (34%), followed by repeat cross-sectional studies (26%) and follow-up studies and time series (17%). The same trend was observed for publications on the USA alone, although with a higher proportion of single cross-sectional studies in the American studies (41%). Publications on other countries also had a majority of cross-sectional studies (33% single, 22% repeat) but these were



**FIGURE 9** Publications by study design ( $n = 483$ ). Note: a publication can only include one study design (mutually exclusive category).

**TABLE 3** Study designs and presence of dominating countries of publications

Study design	N (%) for the whole map		N (%) for publications only covering the 12 dominating countries (out of n = 390)		N (%) for publications only covering the USA (out of n = 141)		N (%) for publications covering other countries than the 12 (out of n = 93)		
	N	%	N	%	N	%	N	%	
Quantitative (all)	376	78	310	79	121	86	66	71	
Follow-up studies and time series	(All)	81	17	68	17	22	16	13	14
	Pre-post	69	14	58	15	13	9	11	12
	Post-post	12	3	10	3	9	6	2	2
Repeat cross-sectional	(All)	121	25	101	26	41	29	20	22
	Pre-pre	3	1	3	1	1	1	0	0
	Pre-post	89	18	74	19	30	21	15	16
	Post-post	29	6	24	6	10	7	5	5
Cross-sectional, post, once	165	34	134	34	58	41	31	33	
Modelling and scenarios	9	2	7	2	0	0	2	2	
Qualitative	63	13	44	11	13	9	19	20	
Mixed methods (quantitative and qualitative)	27	6	21	5	4	3	6	6	
Policy document analyses	17	4	15	4	3	2	2	2	
Total	483	100	390	100	141	100	93	100	

**Note**  
A publication can only include one study design (mutually exclusive category).

followed by qualitative studies (20%) and then follow-up studies and time series (14%). Quantitative studies in all three categories of publications all tended to use more pre-post designs than post-post. However, nearly all policy analyses, mixed-methods studies, modelling studies and scenarios were about the 12 dominating countries alone. Regarding the use of comparison groups, we documented the number of publications reporting on a quantitative study comparing two policies (or more), a policy versus none, or participants or products targeted by a policy versus some not targeted. Overall for the whole map, 57% of quantitative studies involved such a comparison compared with 60% for the 12 dominating countries alone, 66% for the USA alone and 44% for other countries. Thus, except for pre-post designs, publications focusing only on the 12 dominating countries tend to employ more frequently the most robust quantitative designs or features (i.e. follow-up studies and time series, and comparison groups) compared with publications covering other countries, as well as policy document analyses. However, a smaller proportion of their publications employ qualitative methods. The majority of the publications covering the least documented world regions (i.e. Africa, the Middle East and South Asia) were single cross-sectional or qualitative, although the latter were mainly about South Africa.

Regarding the use of quantitative study design by governance approach, 81% of follow-up studies and time-series analyses, and seven of the nine modelling studies assessed regulatory policies. Very few follow-up studies and time series investigated voluntary policies by the public/not-for-profit or private sectors (7% and 11%, respectively). PPPs were mostly assessed with pre-post cross-sectional studies (n = 6). By policy category, most follow-up studies and time-series analyses, and most modelling studies were employed to evaluate economic interventions. Since these were mainly taxes, it explains why these study designs primarily focused on regulatory interventions.

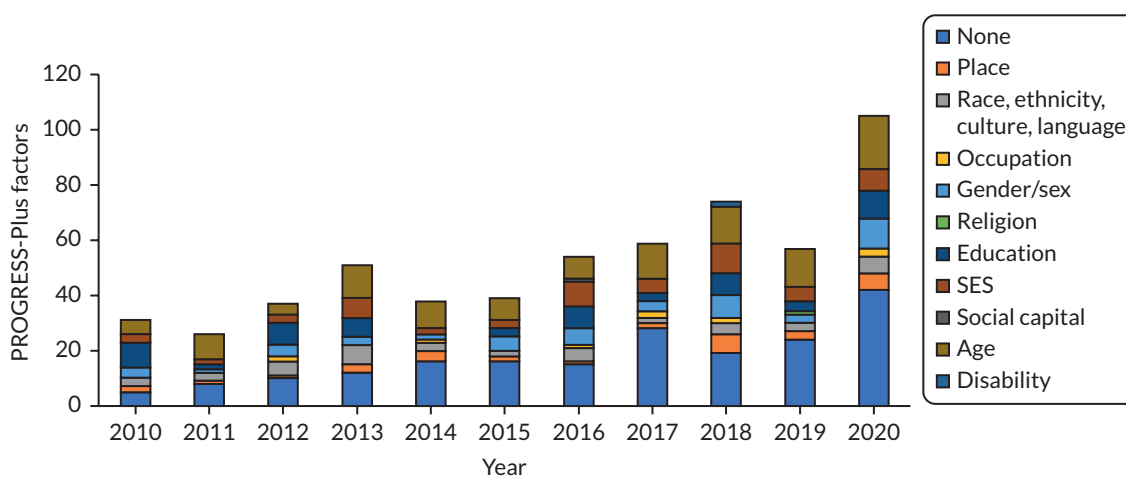
### Health equity as a policy outcome

We documented the number of evaluations assessing policy effectiveness comparing a policy outcome between groups by PROGRESS-Plus equity domains. Overall, out of 389 studies used, 50% did not consider any equity domain, 50% assessed at least one, and 21% measured two or more. Age was the most assessed (30%), followed by education (16%, although these mainly related to school characteristics), SES at the individual level (15%), gender/sex (13%), race and culture (11%) and place (8%), whereas only 11 publications considered occupation, and 1 or 2 examined religion, social capital and disability each. This was using a generous interpretation of the PROGRESS-Plus framework, which also considered characteristics of products and places (rather than just humans) and those contributed to higher numbers for age and education. Equity was most frequently considered in the USA ( $n = 75$  with at least one equity dimension), Australia ( $n = 20$ ), Canada and Mexico ( $n = 18$  each), the UK ( $n = 17$ ), as well as Chile and France ( $n = 8$  each). *Figure 10* illustrates the distribution of publications by year and equity dimension assessed. While the number of quantitative and mixed-methods studies reporting on at least one dimension has increased from 2018, the proportion to the number of studies of effectiveness published per year has reduced, from 72% ( $n = 13$  out of 18) in 2010 to 40% ( $n = 28$  out of 70).

We explored whether evaluations conducted at a smaller scale could capture equity more frequently. In the 15 publications on local policy and/or evaluation in the UK, 8 assessed the effectiveness of a policy. Only four reported on at least one equity dimension: SES ( $n = 4$ ), place ( $n = 1$ ), and age ( $n = 1$ ) representing a similar proportion than for the evidence map, albeit the very small sample size limiting such conclusions.

## Conclusions

We found imbalances across the 483 included studies, suggesting that policy evaluations are conducted and published inequitably across the world both in terms of quantity and quality. Though 70 countries were represented overall, 81% of publications focused on only 12 countries (USA, UK, Australia, Canada, Mexico, Brazil, Chile, France, Spain, Denmark, New Zealand and South Africa), and 30% included the USA. Few evaluations were found about Africa, Central and South Asia and the Middle East. Inequities were also detected in the study designs, with the most quantitative robust methods mainly documenting the abovementioned 12 dominant countries. Few publications reported on PPPs ( $n = 31$ ), and only one assessed the development of voluntary policies led by the public and private sectors each. Using a generous interpretation of the PROGRESS-Plus equity dimensions, we found that not only 50% of publications assessing policy effectiveness did not compare outcomes by any equity domain, but that the proportion of those doing so has decreased over time. Age, education (mainly school characteristics) and SES at individual level were the most frequently assessed dimension, while occupation and education at individual level, religion and culture, social capital and disability were barely considered.



**FIGURE 10** Number of publications comparing policy outcomes by PROGRESS-Plus factors, by publication year. Note: a publication can include more than one health equity dimension (non-mutually exclusive category).



# Chapter 4 Overview of reviews of the effectiveness of regulatory, voluntary and public–private partnership policies to improve food environments and population diet

## Introduction

This chapter reports the methods and findings of the overview of reviews, including direction of effect stratified by population, and by equity dimension, for regulatory, voluntary and partnership approaches.

## Methods

### *Eligibility criteria and quality appraisal*

Fifty initial systematic reviews were identified in the overarching search strategy (see [Chapter 2](#)). Additional screening was comprised first, considering only those assessing the effectiveness of interventions. Within these, only the results sections or subgroup analyses containing a majority of studies meeting the project's eligibility criteria (screened by one reviewer LB) were included. Second, the evidence syntheses without quality or risk-of-bias appraisal were excluded. Third, to limit primary study overlap between systematic reviews, as recommended by Cochrane,<sup>32</sup> the 'most recent, highest quality, "most relevant", or "most comprehensive" systematic review for groups of overlapping reviews' were selected.

The quality of each systematic review was assessed using the checklist for systematic reviews and meta-analyses developed by the SIGN with minor modifications, first, excluding systematic reviews without a quality or risk-of-bias appraisal, and second, merging the two lowest of four categories of overall quality proposed by SIGN.<sup>33</sup> The three resulting categories were as follows: 'high', 'acceptable' and 'low'. We also added guidance for some of the questions to limit variations in interpretation between reviewers (see [Appendix 3, Table 25](#)). Three independent reviewers performed quality appraisal in pairs (LB, SR, CK) in the EPPI-Reviewer Web.

Primary study overlap is a frequent issue in an overview of reviews consisting of having the same primary studies included in multiple systematic reviews. This gives more weight to their findings than those of other primary studies, thus introducing biases, and making data extraction and data synthesis challenging to perform.<sup>32</sup> To overcome this, we employed Cochrane's approach to 'all non-overlapping reviews', and selecting the most recent, highest quality, 'most relevant', or 'most comprehensive' systematic review for groups of overlapping reviews. The strategy for following this recommendation in the overview of reviews was as follows: First, we extracted general policy and study characteristics for all potentially eligible systematic reviews at this point (see [Data extraction](#) for more details). Second, following Cochrane guidance<sup>30</sup> we documented primary study overlap in the systematic reviews by creating a matrix and calculating the 'corrected covered area'. The latter considers the number of publications (including double counting) in evidence syntheses, the number of unique studies, and the number of reviews.<sup>34</sup> Overlaps ranging between 0% and 5% are considered as slight, 6% and 10% as moderate, 11% and 15% as high and more than 15% as very high. Additionally, we documented the number of reviews that overlap with others, the percentage of studies in each review that overlap with others, and the percentage of unique studies that overlap overall. Third, in each group of overlapping reviews, we selected the review that had the highest overall quality (for 'most robust'), the most recent search date (for 'most recent'), and that contributed most to the body of research evidence in terms

of the number of studies included, topic (NOURISHING policy categories covered) and place (World Bank world regions covered) (for 'most relevant or comprehensive'). Justifications for the choices were recorded for reasons of transparency. The selection was made by one reviewer (LB).

### **Data extraction**

General review characteristics extracted in a standardised form consisted of which results sections or subgroup analyses were included and excluded, the number of studies included in these analyses, literature search dates in databases, funding, competing interests, and authors' affiliations. Characteristics of the policies assessed within the selected results sections consisted of countries, policy categories using the NOURISHING framework,<sup>18</sup> the types of outcomes assessed, and the equity domains (or effects for population groups that are prone to health inequalities) represented using the PROGRESS-Plus framework.<sup>20</sup> Data were extracted by one reviewer (LB) and a sample verified by another (CK).

The results of the interventions in the eligible results sections were extracted by policy governance approach, type of outcome and equity domain. Some results sections included non-eligible policies. To keep it simple, we extracted information for the whole section; however, results of policies that did not focus on the food environment were disregarded. Given that the results extracted by equity only covered three of the ten domains (gender, SES, age) of PROGRESS-Plus, we also extracted data on equity from the systematic reviews that had been excluded for reducing primary study overlap. This led to the documentation of two additional domains (race and education) as well as additional outcomes within the domains already covered. We also noted that some systematic reviews had assessed their data or drawn conclusions in relation to a hierarchy or 'level' of interventions and we documented these instances. Lastly, we briefly documented how the policies work (their mechanisms of action) as described by the review authors (usually as part of their results or discussions).

### **Data synthesis**

As expected, a high degree of heterogeneity was observed among the primary studies and systematic reviews in terms of types of policies and outcomes evaluated. We adapted the effect direction plot developed by Thomson *et al.*<sup>26</sup> and Boon *et al.*<sup>27</sup> to visually display non-standardised effects by governance approach, type of outcome and quality rating, but at the review level rather than primary study level. We classified the direction of effect by type of governance approaches compared (regulatory vs. voluntary, regulatory alone, or voluntary alone). Direction of effect was documented independently from statistical significance, consulting primary studies when not reported in the systematic reviews where necessary. The same approach was applied to reporting the number of studies and total participants by outcome. We had planned to assess the level of certainty in the evidence for each outcome using the GRADE framework but information available was insufficient. Thus, as a compromise, the effect direction plot was also used to present jointly the direction of effect, review quality and indirectness.

## **Findings**

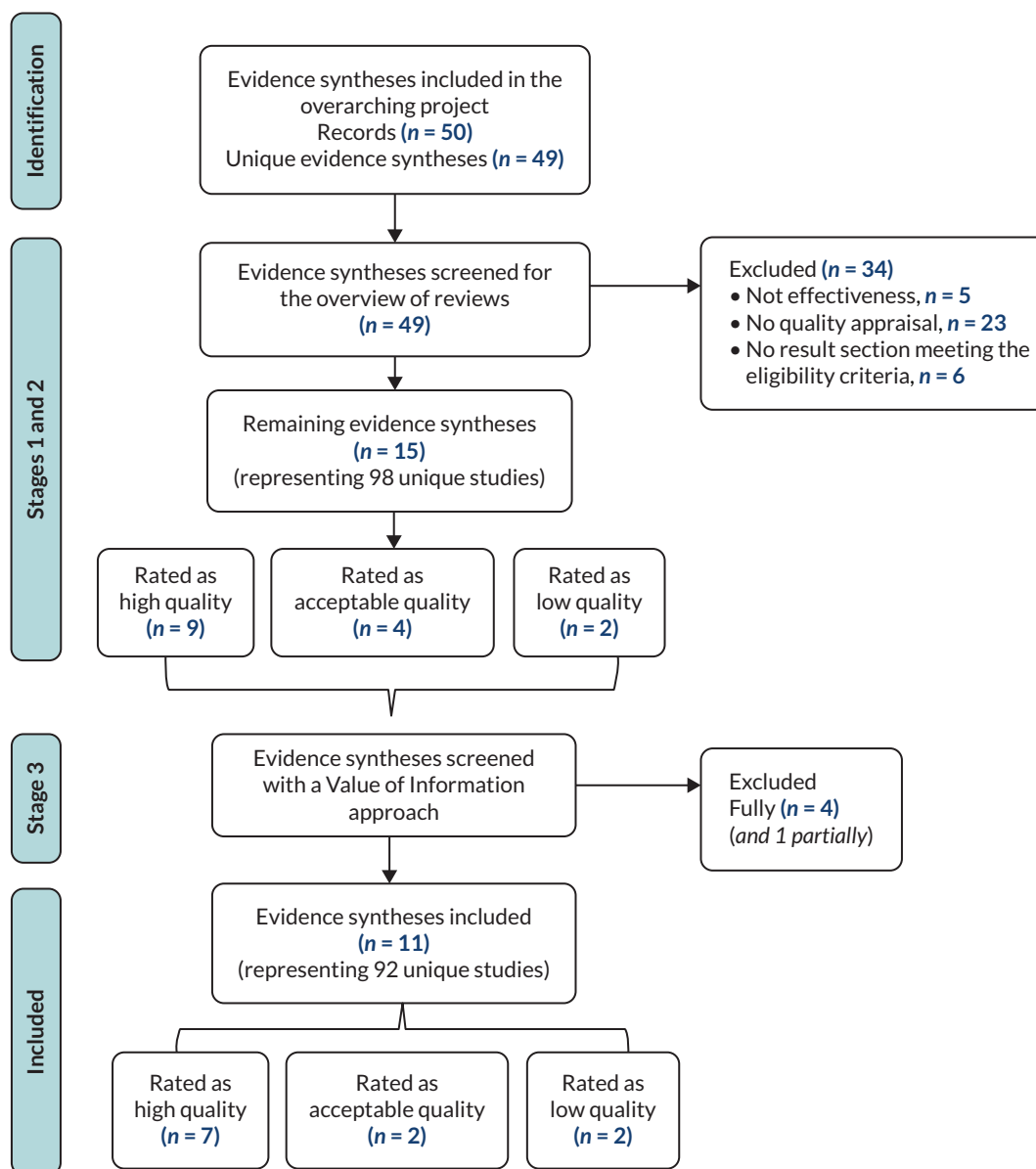
### **Included studies**

As outlined in [Figure 11](#), of the 50 (49 unique) evidence syntheses identified in the overarching search, 5 were excluded as they did not evaluate the effectiveness of policies, 23 for not appraising study quality and 6 for not including a results section meeting the eligibility criteria. This left 15 systematic reviews, which were assessed for primary study overlap. Nine were rated high quality (including three Cochrane reports), four as acceptable and two as low. The assessment of primary study overlap and selection of reviews in each overlapping group of reviews is presented in [Appendix 5, Tables 27 and 28](#). The latter process led to the full exclusion of 4 additional reviews<sup>35-38</sup> (2 of high quality, 2 of acceptable quality) and of 1 results section in an additional review<sup>39</sup> leaving 11 reviews in the overview of reviews (see [Appendix 5, Table 30](#)). However, as explained in the methods, three of the reviews<sup>35,36,38</sup> excluded

because of primary study overlap were used to document effects on specific population groups (equity). The excluded evidence syntheses along with the justifications are listed in the [Report Supplementary Material 1](#). For the sake of transparency, the latter also lists the five publications representing four systematic reviews that were excluded as part of the screening for the overarching project (see [Chapter 2](#)) because of an insufficient focus on governance (i.e. governance was either not documented or documented but not considered in the analysis).

### Primary study overlap

Calculations for the corrected covered area, which is the current recommended method to measure primary study overlap, suggests that before excluding reviews for reducing primary study overlap, overlap was already 'slight' (1.3% overlap). However, 9 of the 15 reviews overlapped with other reviews: 5 with 1 other review, 3 with 2 other reviews, and 1 with 3. Among these nine overlapping reviews, six had 80% or more of their studies included in other reviews; three of which overlapped at 100%. Overall, the 15 reviews included 98 unique primary studies, 17 of which overlapped once (i.e. it was included in 1 other review), and one twice (i.e. it was included in 2 other reviews). The detail of primary study overlap is presented in [Appendix 5, Tables 27–29](#).



**FIGURE 11** PRISMA flow chart representing the selection process. Adapted from the PRISMA template by Page *et al.* (2021).<sup>16</sup>

By excluding reviews to limit primary study overlap, overlap fell down to 0 with 92 unique primary studies and 11 reviews remaining. Among the primary studies excluded, 18 were included in other included reviews, whereas 6 (6%) did not. Yet, excluding the latter six had little impact since one did not assess policies, another one was not an evaluation, and four assessed SSB taxes (two in the USA, one in France and one in Mexico) – a topic that is well covered by other systematic reviews included in the overview.

### **Quality appraisal of systematic reviews**

**Table 4** presents the results for the quality appraisal. Seven were rated high quality (++), two acceptable (+) and two low (-). The main reason for attributing low ratings was inappropriate synthesis methods (in addition to inappropriate or lack of use of quality or risk-of-bias assessment). The main reason for attributing 'acceptable' ratings was inappropriate or lack of use of quality or risk-of-bias assessment. Other common issues related to not listing the excluded studies ( $n = 7$ ) and not reporting competing interests in the included studies ( $n = 6$ ). Most assessments of publication bias were rated as 'not applicable' due to the absence of meta-analysis in the selected results sections.

### **Characteristics of included systematic reviews**

**Table 4** describes the general characteristics of the systematic reviews included. The number of eligible studies per review ranged from 1 to 23. One conducted their search in databases in 2020, four in 2019, while the oldest were in 2015 ( $n = 3$ ). None reported on PPPs. Twenty-eight countries were covered overall, all of which were high or upper-middle income countries according to the World Bank with the exception of Iran, Mongolia and Vietnam. The most assessed countries consisted of the USA ( $n = 6$  systematic reviews), Australia ( $n = 4$ ), as well as Canada, Denmark, Hungary, Mexico and the UK ( $n = 3$  each). All focused on the general population. In terms of real-world policy topics assessed, seven evaluated labelling schemes (on front and back of packages, shelves and menus), five assessed economic interventions (taxes on salt, saturated fat, SSBs/non-essential foods), three included product reformulation initiatives, and two focused on the retail and catering sector. None considered initiatives in schools, nurseries, health care or leisure settings, nor advertising and marketing control. Three focused on SSBs or sugar, two on fat, and two on salt. Regarding the outcomes evaluated, nine investigated effects on consumer behaviour (e.g. dietary intake, purchases/sales), four (on the food environment (e.g. nutrition composition, price), three on health (e.g. heart diseases, obesity), and two on the economy (imports, governments' and food industry's revenue). Two conducted meta-analyses. None of the included systematic reviews reported industry funding though one author in the review by Dodd *et al.*<sup>40</sup> had been a paid consultant for the Novartis Foundation and Midway Corporation; and the systematic review by von Philipsborn *et al.*<sup>46</sup> was partly funded by the Danone Research Center to the National Institute of Public Health, Cuernavaca, Mexico, and two authors have received grants from the latter of the British Nutrition Society.

### **Quality and characteristics of systematic reviews and results sections excluded to reduce primary study overlap**

Four systematic reviews<sup>35-37,50</sup> were fully excluded to reduce primary study overlap, two of which were rated as high quality, and two as acceptable. Patterns in quality appraisal was similar to those included in the overview. Details of the quality appraisal is presented in [Appendix 5, Table 30](#). The additional systematic review,<sup>39</sup> which had a results section excluded to reduce overlap had an acceptable quality ([Table 5](#)). The five reviews and results section included between three and eight studies and covered the USA ( $n = 4$ ), Denmark ( $n = 2$ ), as well as in Canada, Costa Rica, France, Hungary and Mexico ( $n = 1$  each). Four assessed different types of taxes (SSBs, sugar, saturated fat and restaurants), and another examined trans-fats relating to labelling, reformulation, and the retailing and catering sector. All assessed consumer behaviours, four assessed health outcomes, three the food environment and one economic impacts. Thus, apart from a few health and economic outcomes, excluding these to reduce primary study overlap appears not to have affected the scope of the studies included, but also reduced the overemphasis on the USA and on taxation that would have been present otherwise.



**TABLE 4** Characteristics of the included evidence syntheses ( $n = 10$ ), ordered by quality and literature search date

Lead author (year)	Section(s) of synthesis in systematic reviews included and excluded from the data extraction and data synthesis in the overview of reviews	Dates searched	N studies included Type of synthesis	Countries	Categories of eligible policies	Types of outcomes measured	Funding reported	Declaration of competing interests
Dodd (2020) <sup>40</sup> High (++)	<b>Included:</b> Findings from real-world evaluation of impact <b>Excluded:</b> Findings from modelling studies, findings from experimental studies, perceptions of taxation of high-salt foods	January 2000– October 2019	N = 4 (out of 18) Narrative	FIJ, HUN, MEX, TONG	U-Salt taxes (on salt in non-essential foods and imports of salty foods)	Consumer behaviour (dietary intake, sales); economy (imports, government revenue)	No funding	Declared industry and non-industry competing interests (e.g. Novartis)
Hillier-Brown (2017) <sup>41</sup> High (++)	<b>Included:</b> Changing pre-packed children's meals, voluntary calorie labelling  <b>Excluded:</b> Trans-fat law (local), price increases for unhealthy choices (trial), calorie labelling law ×2 (local), Incentives (rewards) (trial), price reductions for healthier choices (experiment), signposting ×2 (trials, local), personalised receipts (not envt), Award schemes (local), telemarketing (not envt).	January 1993– October 2015	N = 2 (out of 30) Narrative	USA	N-Menu Labelling S-Retail and food services (children's meal content; TV promotions)	Consumer behaviour (sales/purchase, use of labels)	Non-industry funding	None declared
Lhachimi (2020) <sup>42</sup> High (++)	<b>Included</b> All	Until October 2019 <sup>a</sup>	N = 2 (out of 2) Narrative	DEN	U-Saturated fat tax	Health (overweight and obesity); consumer behaviour (dietary intake based on sales)	Non-industry funding	Declaration of non-industry interests only

continued

**TABLE 4** Characteristics of the included evidence syntheses ( $n = 10$ ), ordered by quality and literature search date (*continued*)

Lead author (year)	Section(s) of synthesis in systematic reviews included and excluded from the data extraction and data synthesis in the overview of reviews	Dates searched	N studies included Type of synthesis	Countries	Categories of eligible policies	Types of outcomes measured	Funding reported	Declaration of competing interests
Crocker (2020) <sup>43</sup> High (++)	<b>Included:</b> Interrupted-time-series studies <b>Excluded:</b> Experimental studies	January 2017–April 2019	N = 3 (out of 14) Narrative	CHL, ECU, UK	N-FOP labelling	Consumer behaviour (sales/purchases, dietary intake); food envt (nutritional composition)	Non-industry funding	None declared
Pfinder (2020) <sup>44</sup> High (++)	All	Until September 2019	N = 1 (out of 1) Narrative	HUN	U-tax on non-essential food (focus on sugar)	Consumer behaviour (dietary intake based on sales, expenditures) <sup>b</sup>	Non-industry funding	Declaration of non-industry interests only
Teng (2019) <sup>45</sup> High (++)	<b>Included</b> All	Until June 2018	N = 18 (out of 18); 15 of which in a meta-analysis	CHL, FIN, FRA, HUN, MEX, SPA, USA	U-Tax on SSBs and non-essential foods	Consumer behaviour (intake, purchases/sales)	Non-industry funding	Declaration of non-industry interests only
von Philipsborn (2019, 2020) <sup>46,47</sup> High (++)	<b>Included:</b> A.2 Nutritional rating score shelf labels, E.1 Voluntary industry initiatives. <b>Excluded:</b> The rest (A.1, A.3, A.4, B.1, B.2, B.3, B.4, B.5, C.1, C.2, C.3, F.1, F.2, F.3, F.4, F.5, G.1, G.2, G.3, G.4, H.1, H.2) (trials and/or local level)	Until January 2018	8 (out of 58) Meta-analysis (C.1) Narrative (A.2, E.1)	AUS, CAN, UK, USA	N-Labeling (on-shelf); U-Price increase on SSBs in shops, leisure centres and restaurants; I-Reformulation (industry pledges) Focus on SSBs	Consumer behaviour (intake, purchases/sales); economy (industry revenue)	Non-industry funding	Declaration of industry interests, including the food industry (Nestlé, Danone, Weight Watchers)
Downs (2017) <sup>48</sup> Acceptable (+)	<b>Included:</b> Real-world policies <b>Excluded:</b> Modelling studies	1990–August 2017	N = 23 (out of 32) Narrative	BRA, CAN, CR, DEN, IRAN, KOR, MEX, NET, USA, Americas (partly not specified)	N-trans-fat labelling; I-Trans-fat reformulation/limits/ban by manufacturers; S-Retail and food services (trans-fat reformulation/limits/ban)	Health (heart diseases and mortality, trans-fat in body); consumer behaviour (dietary intake); food envt (nutritional composition)	Non-industry funding	None declared

Lead author (year)	Section(s) of synthesis in systematic reviews included and excluded from the data extraction and data synthesis in the overview of reviews	Dates searched	N studies included Type of synthesis	Countries	Categories of eligible policies	Types of outcomes measured	Funding reported	Declaration of competing interests
Sisnowski (2017) <sup>39</sup> Acceptable (+)	<b>Included:</b> Nutritional labelling of products  <b>Excluded:</b> Menu labelling (local), subsidies for healthy foods, procurement standards for public institutions (local), improvement of food infrastructure (mainly local); <b>taxation (excluded due to primary study overlap)</b>	January 2004– October 2015	N = 1 (out of 36) Narrative	AUS	N-Back-of-pack labelling	Food envt (nutrition composition, price)	Non-industry funding	None declared
Rincón-Gallardo (2020) <sup>49</sup> Low (-)	<b>Included:</b> All	January 2000– February 2020	N = 15 (out of 15) Narrative	AUS, CAN, UK, USA	N-Menu labelling	Food envt (availability, nutrition composition)	NR except publication costs	None declared
Hyseni (2017b) <sup>50</sup> Low (-)	<b>Included:</b> Multicomponent interventions <b>Excluded:</b> Dietary counselling in school based and worksite interventions, Dietary counselling at community level, Nutrition labelling (RCT), Media campaigns, Reformulation, Labelling, Taxes	30 October 2015	N = 15 (out of 70) Narrative	AUS, CHI, DEN, FIN, FRA, ICE, IRE, JAP, KOR, LIT, MONG, SLOV, TKY, UK, USA, VIET, Unclear (75 countries)	N-Salt labelling (FOP, BOP); I-salt reformulation by manufacturers	Health (heart diseases and mortality); consumer behaviour (dietary intake)	Non-industry funding	None declared

BOP, back-of-pack; Env, environment; NR, not reported. Countries: AUS, Australia; BRA, Brazil; CAN, Canada; CHI, China; CHL, Chile CR, Costa Rica; DEN, Denmark; ECU, Ecuador; FIJ, Fiji; FIN, Finland; FRA, France; HUN, Hungary; ICE, Iceland; IRAN, Iran; IRE, Ireland; JAP, Japan; KOR, Republic of Korea; LIT, Lithuania; MEX, Mexico; MONG, Mongolia; NET, the Netherlands; SLOV, Slovenia; SPA, Spain; TKY, Turkey; TON, Tonga; UK, United Kingdom; USA, United States of America; VIET, Vietnam.

a The main text says September but details in the bullet points and appendix say October.

b Pfinder *et al.* also aimed to measure effects on health (overweight and obesity) but found no studies reporting on the latter.

**TABLE 5** Quality appraisal of included systematic reviews (n = 11)

Lead author (year)	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12a	1.12b	Overall rating
Croker (2020) <sup>43</sup>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	N/A	Yes	No	High (++)
Dodd (2020) <sup>40</sup>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	N/A	Yes	No	High (++)
Downs (2017) <sup>48</sup>	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	N/A	Yes	No	Acceptable (+)
Hillier-Brown (2017) <sup>41</sup>	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	High (++)
Hyseni (2017b) <sup>38</sup>	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	N/A	Yes	No	Low (-)
Lhachimi (2020) <sup>42</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	High (++)
Pfinder (2020) <sup>44</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	Yes	Yes	High (++)
Rincón-Gallardo (2020) <sup>49</sup>	No	Yes	Yes	?	Yes	No	Yes	Yes	No	No	N/A	Yes	?	Low (-)
Sisnowski (2017) <sup>39,a</sup>	Yes	Yes	No	No	Yes	No	Yes	Yes	No	Yes	N/A	Yes	No	Acceptable (+)
Teng (2019) <sup>45</sup>	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	High (++)
von Philipsborn (2019, 2020) <sup>46,47</sup>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High (++)

a Partly excluded to reduce primary study overlap.

#### Notes

Source: Quality assessment tool used: SIGN;<sup>33</sup> Legend: **1.1** Is the research question clearly defined and the inclusion/exclusion criteria listed in the paper? **1.2** A comprehensive literature search is carried out; **1.3** At least two people should have selected studies; **1.4** At least two people should have extracted data; **1.5** The status of publication was not used as an inclusion criterion; **1.6** The excluded studies are listed; **1.7** The relevant characteristics of the included studies are provided; **1.8** The scientific quality of the included studies was assessed and reported; **1.9** Was the scientific quality of the included studies used appropriately? **1.10** Appropriate methods are used to combine the individual study findings; **1.11** The likelihood of publication bias was assessed appropriately; **1.12a** Conflicts of/competing interests (Col) are declared for the SR; **1.12b** Col are reported for the included studies.

Overall quality assessment ratings: (+) Acceptable, (-) Low, (++) High Quality, (?) Unclear.

### Direction of effects by governance approach for the general population

*Table 6* describes the directions of effects of interventions categorised by types of governance approaches and their comparison, and types of outcomes. The first column describes 25 groups of outcomes grouped into consumer behaviours ( $n = 15$ ), the food environment ( $n = 5$ ), health ( $n = 3$ ) and the economy ( $n = 2$ ). The next three columns describe three categories of governance approaches that were assessed or compared: regulatory versus voluntary, regulatory alone and voluntary alone. As mentioned earlier, no review assessed PPPs. In each of these cells, the direction of the arrow indicates whether results were overall positive (or desired), negative (or undesired) or mixed. In the column comparing regulatory to voluntary actions, a larger triangle indicates a larger effect compared to the other governance approach. Twelve (48%) categories of outcomes only included regulatory interventions, five (20%) only voluntary actions and eight (32%) both.

### Both regulatory and voluntary

Eight outcome categories measuring both regulatory and voluntary approaches were reported in four systematic reviews: two of low quality, one acceptable and one high. Information mainly relied on cross-sectional (single and repeat) and follow-up studies. The policies assessed were in 13 countries across 4 World Bank world regions: Australia, Canada, Chile, China, Costa Rica, Denmark, Ecuador, Finland, Japan, Republic of Korea, the Netherlands, the UK and the USA. Two groups of outcomes measured health, four consumer behaviour and two the food environment. Overall, they suggest positive effects for both governance approaches, except for calorie menu labelling, which was only positive for regulations. Few regulatory and voluntary policies could be directly compared due to the high heterogeneity in the measurement methods. Among those that could be, a larger arrow in the effect direction plot indicates a greater effect size. This includes interventions for reducing trans-fats in the food supply and diet: regulatory bans appear to be the most promising (based on one acceptable quality review).<sup>48</sup>

Regarding effects on health, Downs *et al.* (acceptable quality)<sup>48</sup> found that in Costa Rica, following self-regulatory trans-fat targets, the concentration of trans-fat in subcutaneous adipose tissue had reduced sufficiently not to be associated with increased risk of myocardial infarction anymore. In the USA, only 3 years after the local trans-fat ban (or regulatory restrictions) in restaurants in New York City, and using hospital admissions data, cardiovascular disease (CVD) mortality rates had declined by 4.5%, with a greater reduction in stroke in young people than in the normal trend. Regarding salt, according to Hyseni *et al.*<sup>50</sup> (low quality), in Finland about 30 years after implementing both regulatory labelling and voluntary reformulation, stroke and coronary heart disease (CHD) mortality had fallen by over 60–75%. A similar reduction in stroke mortality was noted in Japan, where voluntary labelling, voluntary reformulation and awareness campaigns had been implemented. In England, the voluntary salt targets were associated with a fall in stroke mortality from 128/1,000,000 in 2003 to 82/1,000,000 in 2011 (36% reduction,  $p < 0.001$ ).

Regarding effects on consumer behaviours, although both regulatory and voluntary approaches appear to be effective, in Downs *et al.*<sup>48</sup> (acceptable quality) the Danish trans-fat ban (regulatory) was shown as most effective to reduce trans-fat intake since it had eliminated trans-fat from the food supply. By contrast, in Costa Rica and the Netherlands (self-regulated trans-fat limits), consumption reduced by –38% and –20%, respectively. In Canada and the USA, which both employed mandatory labelling and voluntary reformulation, trans-fat concentrations reduced by –54% to –58% in plasma serum (Canada and USA) and by –30% to –74% in breastmilk (Canada) (reported as a proxy for consumption). Hyseni *et al.*<sup>50</sup> (low quality) found that all voluntary and mixed-approach salt policies reduced salt intake, although none assessed were purely regulatory. Effect size in Finland (mixed approach) and Japan (voluntary) was similar (–4 g/day and –3.9 g/day, respectively) while it was lower in the UK (voluntary, –1.4 g/day). They explained part of the success of the UK with the ‘degree of political pressure [that was] applied to the food industry and [the] regular, independent monitoring’. Lastly, in Croker *et al.*<sup>43</sup> (high quality), the effect of FOP labels was measured using analyses of sales or purchase data for the regulatory warning label in Chile (fruit juices, breakfast cereals, chocolate, candies and cookies), the regulatory traffic lights

**TABLE 6** Direction of effect by comparison of governance approaches and outcome for the general population

Key outcomes reported	Direction of effect (or association) by comparison of governance approaches ( <i>k</i> = <i>N</i> studies, <i>n</i> = <i>N</i> participants; colour/signs = quality)			Policies and governance approaches (countries)
	Regulation (R) vs. voluntary (V)	Regulatory alone	Voluntary alone	
<b>Health</b>				
Heart diseases and mortality	R▲, V▲ diverse measures of MI, stroke and mortality rates <i>k</i> = 3, <i>n</i> = 10,337; (+)			Trans-fat policies: <sup>48</sup> V self-regulated limits (Costa Rica), R trans-fat limits or ban in restaurants (NYC, USA)  Salt policies: <sup>50</sup> V reformulation + R label + campaigns (Finland), V reformulation + V label + campaigns (Japan, UK)
	RV▲, V▲ stroke and CHD mortality <i>k</i> = 3, (-)			
<b>Behaviours</b>				
Dietary intake of unhealthy foods or nutrients		◀▶ salt intake <i>k</i> = 2, <i>n</i> = 883 individuals + 1395 households; (++)		Taxes on salt reduction in <sup>40</sup> non-essential food (Hungary); imported instant noodles (Tonga)
	R▲, V▲ trans-fat intake <i>k</i> = 4, <i>n</i> = 34,031; (+)			Trans-fat reduction policies: R ban (Denmark), R labelling + V limits (Canada), V self-regulated limits (Costa Rica, the Netherlands) <sup>48</sup>
	R▲, V▲ trans-fat in plasma serum and breastmilk <i>k</i> = 5, <i>n</i> = 3869; (+)			Trans-fat policies: <sup>48</sup> R labelling + V limits (Canada), self-regulated limits (Costa Rica), R labelling (USA)
	RV▲, V▲ salt intake <i>k</i> = 7; (-)			Salt policies: V reformulation + R label + campaigns (Finland), V reformulation + V label + campaigns (China, Japan, UK) V bread reformulation + campaigns (France) <sup>50</sup>
			▲ total and sat fat intake (via sales tax) <i>k</i> = 2; 2000 households + 1293 supermarkets; (++)	

Key outcomes reported	Direction of effect (or association) by comparison of governance approaches ( <i>k</i> = <i>N</i> studies, <i>n</i> = <i>N</i> participants; colour/signs = quality)			Policies and governance approaches (countries)
	Regulation (R) vs. voluntary (V)	Regulatory alone	Voluntary alone	
Purchases and sales of healthy or unhealthy foods		▲ difference in mean intake of taxed vs. untaxed sugar-added food <i>k</i> = 1, <i>n</i> = 40,210 households; (++)		Tax on non-essential food (Hungary) <sup>44</sup>
	R▲, V▲ range of food and SSBs purchased <i>k</i> = 3; (++)			FOP labels: R warning (Chile), R traffic lights (Ecuador), V Guideline Daily Amount (UK) <sup>43</sup>
		▲ purchases of taxed food <i>k</i> = 1, (++)		Tax on non-essential food (Mexico) <sup>40</sup>
			▲ Total energy, SSBs and healthier option purchases <i>k</i> = 1, <i>n</i> = 30 chain restaurants; (++)	V change in sides sold with children's meals in three fast-food chains + TV promotions about healthier beverages (USA) <sup>41</sup>
			◀▶ % customers choosing lowest-energy option <i>k</i> = 1, <i>n</i> = 30 restaurants; (++)	V change in sides sold with children's meals in three fast-food chains + TV promotions about healthier beverages (USA) <sup>41</sup>
			▲ purchases of energy, fat, sodium and carbohydrates in main meals <i>k</i> = 1, <i>n</i> = 6 restaurants and ~16,000 main meals; (++)	V menu-labelling in restaurants (USA) <sup>41</sup>
			◀▶ sales of minced beef, cream, sour cream <i>k</i> = 2; 2000 households + 1293 supermarkets; (++)	Tax on total and saturated fat (Denmark) <sup>42</sup>

continued

**TABLE 6** Direction of effect by comparison of governance approaches and outcome for the general population (*continued*)

Key outcomes reported	Direction of effect (or association) by comparison of governance approaches ( <i>k</i> = <i>N</i> studies, <i>n</i> = <i>N</i> participants; colour/signs = quality)			Policies and governance approaches (countries)
	Regulation (R) vs. voluntary (V)	Regulatory alone	Voluntary alone	
Intake, sales and purchases combined			<p>▲ sales of least healthy SSBs and beverages <i>k</i> = 2, <i>n</i> = 442 stores; (++)</p> <p>◄► SSBs sold/purchased (<i>k</i> = 3, <i>n</i> = 61,126 households + 17 companies) (++)</p>	<p>V self-regulation on-shelf Guiding Star labelling (Canada and USA)<sup>46</sup></p> <p>V self-regulation/pledges:<sup>46</sup> HWCF Market Place Pledge (by manufacturers about calorie) and Walmart's Healthier Food Initiative (USA)</p> <p>Tax on non-essential food (Hungary).<sup>44</sup></p>
		<p>▲ difference in mean expenditure on taxed vs. untaxed sugar-added food <i>k</i> = 1, <i>n</i> = 40,210 households; (++)</p> <p>▲ SSBs intake/sales/purchases <i>k</i> = 15, <i>n</i> = 539,952; (++)</p>		<p>SSB taxes (Chile, France, Mexico, Spain, USA)<sup>45</sup></p>
	Use of labels			<p><b>Noticing and using nutrient menu labels</b> <i>k</i> = 1, <i>n</i> = 6 non-chain restaurants and ~16,000 main meals V▲</p>
<b>Food environment</b>				
Food and drinks nutrition content		<p>▲ soft drink sugar content <i>k</i> = 1; (++)</p>		<p>R traffic light FOP label (Ecuador)<sup>43</sup></p>
	<p>R▲, V▲ trans-fat content <i>k</i> = 8, <i>n</i> = 13,123 products + 6969 purchases; (+)</p>			<p>Trans-fat policies:<sup>48</sup> R ban (Denmark, NYC), R labelling + V limits (Canada), R labelling (USA, Korea), V self-regulated limits (Costa Rica, Netherlands)</p>
	<p>R▲, V◄► calorie content <i>k</i> = 11, <i>n</i> = 678 restaurant chains; (-)</p>			<p>Calorie menu labelling:<sup>49</sup> R (Australia, Canada, USA), V (UK)<sup>a</sup></p>



Key outcomes reported	Direction of effect (or association) by comparison of governance approaches ( <i>k</i> = <i>N</i> studies, <i>n</i> = <i>N</i> participants; colour/signs = quality)			Policies and governance approaches (countries)
	Regulation (R) vs. voluntary (V)	Regulatory alone	Voluntary alone	
Price		▲ price of high- and low- fat food <i>k</i> = 2; 2000 households + 1293 supermarkets; (++)		Tax on saturated fat (Denmark) <sup>42</sup>
Labelling adequacy/ compliance		▼ nutrient content <i>k</i> = 1; 350 product labels matching nutrition content; (+)		R back-of-pack labelling (Australia) <sup>39</sup>
<b>Economy</b>				
Government revenue		▲ tax gain for govt <i>k</i> = 1; (++)		Tax on non-essential food (Mexico) <sup>40</sup>
Food imports		▼ volume of instant noodles imported <i>k</i> = 1, <i>n</i> = N/A (imports data); (++)		Tax on imported instant noodles (Tonga) and MSG (Fiji) <sup>40</sup>

HWCF, Healthy Weight Commitment Foundation; MI, myocardial infarction; MSG, monosodium glutamate; N/A, not applicable; R, regulatory; Sat fat, saturated fat; V, voluntary. a Chile: fruit juices, breakfast cereals, chocolate, candies and cookies; Ecuador: SSBs; UK: calories from biscuits, breakfast cereals and SSBs.

#### Notes

No information on PPPs was reported. *k* = *N* studies referring to the outcome; *n* = total *N* participants; quality ratings correspond to (-) = low quality; (+) = acceptable quality, (++) = high quality.

Symbols: The triangles illustrate the overall direction of effect or association on health and health-related outcomes independently from statistical significance. ▲ = desirable effect, ▼ = undesirable effect, ◀▶ = inconsistent effect. Smaller letters and triangles represent lesser effects compared to those with bigger letters and triangles (only applicable to comparisons of regulatory and voluntary approaches). Sample size: The smallest sample size was selected for studies that compare samples at different time points.

in Ecuador (SSBs) and the voluntary Guideline Daily Amounts that was in place before the traffic lights in the UK (calories from biscuits, breakfast cereals and SSBs). We could not directly compare governance approaches, but both had some positive effects.

As for the food environment, Downs *et al.*<sup>48</sup> (acceptable quality) reported clear impacts for trans-fat policies on product content with the regulatory ban in Denmark leading to complete elimination of trans-fats in the food supply. Rincón-Gallardo *et al.*<sup>49</sup> (low quality) examined 11 studies on menu calorie labelling policies in restaurants in the USA (regulatory,  $n = 8$  studies), Australia (regulatory,  $n = 2$ ) and the UK (voluntary,  $n = 1$ ). All eight American studies showed a positive effect on menu calorie content whereas this was mixed in Australia (it had reduced in some food items and increased in others) and the UK (menus contained 45% less fat and 60% less salt but calorie, fat, sugar and sodium increased in some menu categories). Given that all positive results are about the same country, it is unclear whether this is due to differences in country contexts or policy processes. Rincón-Gallardo<sup>49</sup> has noted the challenges of implementing regulatory menu labelling at the subnational level (e.g. state), as this was the case in Australia: it can create different regulations for the same restaurant chains to implement in different regions, including definitions of what constitutes a 'chain'.

### Regulatory approaches alone

The 12 outcome categories measured for regulatory approaches alone were reported in 6 systematic reviews (for 10 countries across 3 World Bank world regions: Australia, Denmark, Ecuador, Fiji, France, Hungary, Mexico, Spain, Tonga and the USA). Seven groups of outcomes were about consumer behaviours, three about the food environment, and two about economic outcomes (none on health). Eight showed positive effects, two showed mixed effects (salt intake and high-fat food sales) and two negative effects (labelling compliance and food imports). All came from high-quality systematic reviews except labelling compliance, which was from a review rated acceptable. Although effects for regulatory approaches might appear mixed overall, this might be due to the type of policy and outcome assessed. For instance, one negative result was the very low compliance in relation to back-of-pack labels in Australia. However, this has more to do with policy implementation than direct effects on the environment like affordability, availability or accessibility. Regarding taxes, as suggested below, those on SSBs and sugary food appear promising. Evaluations of taxes relating to salt suggest a lack of effectiveness but this might have more to do with the narrow focus of some of the taxes: one of the three taxes assessed was only on imported instant noodles (in Tonga) and another on monosodium glutamate (MSG) sold in bag (in Fiji). Evidence on the effectiveness of a tax on saturated fat is limited by the limited experience worldwide (Denmark only) as well as number and scope of evaluations. On the one hand, according to Dodd *et al.*<sup>40</sup> (high quality), in Mexico and using panel household data before and 2 years after the tax implementation, the tax on non-essential foods was associated with a 6% reduction in purchases of taxed foods (all categories).<sup>40</sup> In their meta-analysis, Teng *et al.*<sup>45</sup> (high quality) showed that the equivalent of a 10% SSB tax in Chile, France, Mexico, Spain and the USA corresponded with an average reduction in beverage purchases and dietary intake of 10.0% (95% CI -5.0% to -14.7%,  $n = 17$  studies), although with high heterogeneity ( $I^2 = 97\%$ ). The largest impacts were for the highest taxes, that is an ad valorem equivalent rate of 33.3% in Philadelphia (USA), 21.9% in Berkeley (USA) and 11.4% in Catalonia (Spain). There was also a non-significant 1.9% increase in total untaxed beverage consumption (95% CI -2.1% to 6.1%,  $n = 6$  studies in France, Mexico, Spain and the USA). Using a single interrupted time series, Pfänder *et al.*<sup>44</sup> (high quality) suggested that the Hungarian tax on non-essential food led to a reduced intake and expenditure on taxed sugar-added food compared to untaxed ones. On the other hand, using sales data from two interrupted time series by the same authors, Lhachimi *et al.*<sup>42</sup> (high quality) showed varied effects for the Danish tax on saturated fat intake and sales of high-fat foods – although this might be due to the limited sample of foods assessed (minced beef, cream, sour cream in one study; and butter, butter blends, margarine and oils in the other). In the first study, total fat intake declined by about 41.8 g per week per person ( $p < 0.001$ ); in the second, sales reduced by 4.2% for minced beef and 5.8% for cream but increased by 0.5% for sour cream sales.<sup>42</sup> As for salt, effects on dietary intake based on surveys conducted before and after tax implementation were also mixed in Hungary and Tonga, although the taxes and outcomes assessed were quite different.<sup>40</sup> In Hungary,

the proportion of adults consuming taxed salty snacks increased from 69% to 71%, but among people consuming salty snacks or condiments, 16% and 11%, respectively, either reduced intake or changed for a cheaper brand. Only 5% of salty snack eaters reported selecting healthier options. In Tonga, 70% of people surveyed reported not having changed their consumption of instant noodles after a tax on imported instant noodles. The review authors reported that people had substituted imported noodles with noodles produced locally.

For the food environment, according to an interrupted time series reported in Croker *et al.*<sup>43</sup> (high quality), the regulatory traffic light labels in Ecuador encouraged product reformulation for soft drinks: mean sugar content decreased by 0.93 g per 100 ml. The interrupted time series in Denmark mentioned above (high quality) also mention that the tax on saturated fat was passed on to consumers for selected high-fat products, sometimes at higher rates than the tax itself, while prices for the low-fat options of these products reduced ( $p < 0.001$ , no precision estimate). On the other hand, Sisnowki *et al.*<sup>39</sup> (acceptable quality) documented a cross-sectional study assessing whether back-of-pack labels of 350 products in Australia matched their actual nutrition content. Only 7% of products were 100% compliant.

As for economic outcomes, Dodd *et al.*<sup>40</sup> (high quality) reported that the tax on non-essential foods in Hungary contributed to 30% of tax revenue gain. On the other hand, import taxes on instant noodles in Tonga or MSG sold in bags in Fiji did not refrain imports of such products. Imports of instant noodles in Tonga drastically declined in the first year following the tax (from 2,083,000 kg in 2014–5 to 439,000 kg in 2016–7 but doubled to reach 806,000 kg in 2017–8, despite the tax also doubling during that time. In Fiji, MSG imports rose from < 50,000 kg in 2011 to 200,000 kg in 2013.

### Voluntary approaches alone

The five groups of outcomes measured for voluntary approaches come from two high-quality systematic reviews. All policies were from the private sector, about the USA (and one also about Canada) and investigated purchases and sales in either the retail or restaurant sectors. Four showed positive effects and one mixed effects. Overall, limited data from the USA suggested positive effects on consumer awareness of the policy itself for labelling initiatives in supermarkets and restaurants (based on two studies); positive effects on sales of SSBs, healthy food and beverages options, and/or nutrients in restaurants following on-self labelling in supermarkets (one study), calorie menu labelling (one study), and changing defaults in children's meals (one study); and mixed effects on sales of SSBs (measured as volume and calorie sold) in large retail chains (three studies).

In the retail sector, von Philipsborn *et al.*<sup>46</sup> found variable effectiveness in relation to SSB sales from three studies by the same team in the USA ( $n = 61,126$  households + 17 companies) for assessing industry-led pledge-based programmes to improve the food supply: the Healthy Weight Commitment Foundation (HWCF) Market Place Pledge by food and drinks manufacturers, and the Healthier Food Initiative at Walmart's. A controlled before–after study by Ng *et al.*<sup>51</sup> found that energy sold from SSBs from companies participating (P) in the healthy weight commitment (HWC) decreased by  $-14$  kcal per capita/day versus  $-3$  kcal for non-participating companies (no precision estimates); an interrupted time series also by Ng *et al.* and on the same pledge found that it did not decrease as much as anticipated ( $p < 0.001$ , shown visually only); another interrupted time series by Taillie *et al.*<sup>52</sup> on the Healthier Food Initiative at Walmart's reported that the percentage volume of SSB purchased at Walmart decreased more than expected ( $p < 0.01$ , shown visually only). Certainty in the evidence was rated as very low. The same systematic review also included on an interrupted time series in the USA and a controlled-before–after study in Canada evaluating the Guiding Star, a commercially driven voluntary shelf-labelling scheme for supermarkets. They found that sales of SSBs or all beverages with zero stars (the least healthy) decreased (by  $-27.3\%$  after 16 months in the USA for SSBs, no absolute numbers available for all beverages in Canada). Six months after implementation, a 'modest' proportion of clients 'were aware of, understood, and trusted' the system, and there was a strong support for supermarket labelling schemes. Certainty in the evidence was rated low.

In restaurants, Hillier-Brown *et al.*<sup>41</sup> reported on two cross-sectional studies on two different initiatives. The first one analysed transactions from 30 fast-food chain-owned restaurants to evaluate voluntary changes in children's meals. The chains had also promoted healthier beverage options on television. Improvements were noted in the total energy, SSBs and options purchased, but the proportion of customers buying the lowest-energy option did not change. The second study assessed the effects of a voluntary menu labelling for calories, fat, sodium and carbohydrates in six non-chain restaurants on the purchases of the latter nutrients from about 16,000 mains. They found a significant decrease of purchases of energy, fat and sodium but no change for carbohydrates. A survey suggested that 71% of customers had noticed the labels, and about a fifth reported that the labels made them choose mains that contained a lower content in energy or fat.

### **Direction of effects for specific population groups (equity)**

This section reports findings for specific population groups using the PROGRESS-Plus equity dimensions. Data come from seven systematic reviews: four of high quality, two acceptable and one low. Four of them<sup>44,45,49,50</sup> were included in the whole overview of reviews, while three<sup>35,36,38</sup> had previously been excluded to reduce primary study overlap. [Table 7](#) illustrates the directions of effect stratified by PROGRESS-Plus dimension while the specific results extracted for each review are presented in the [Report Supplementary Material 2](#). Only two policies, in two different reviews, were not regulatory. Both provided information on gender. The direction of the arrow indicates whether results were overall positive (or desired), negative (or undesired) or mixed while its size reflects the sample size. Most policies were American state SSB taxes, and most results relied on a single policy, although some evaluations had large sample sizes. Only 5 out of 10 dimensions were documented. SES was the most frequently documented. No information was found about place, religion, occupation, social capital and disability. Effects were generally positive for the population groups evaluated for race/ethnicity and gender, and mixed for SES, education and age.

**Race/ethnicity** was analysed in two systematic reviews. According to Hyseni *et al.*<sup>38</sup> (high quality), following the introduction of regulatory labelling and voluntary limits for trans-fats in the USA, trans-fat concentrations in blood samples of white (non-Hispanic) adults ( $n = 229$ ) fell by about 56% over 9 years (reduced by 24.3  $\mu\text{mol/l}$ ; 95% CI 19.6 to 29.0). Alagiyawanna *et al.*<sup>36</sup> (acceptable quality) reported one study that found an association between American state taxes on SSBs and soft drink consumption among African American children and adolescents (direction of effect presumably positive), and in another study that effects on body mass index (BMI) varied by race and ethnicity (no details).

**Gender** was documented in two systematic reviews. In Alagiyawanna *et al.*<sup>36</sup> (acceptable quality), two studies found a negative association between state taxes on SSBs and fast-food restaurants and women's BMI. One ( $n = 1,948,833$ ) recorded a reduction of 0.55  $\text{kg/m}^2$ , ( $p < 0.05$ ) while effect size and precision estimates were not provided for the other. Hyseni *et al.*<sup>50</sup> (low quality) noted a reduction in salt intake in both men and women between the introduction of regulatory salt labelling and voluntary limits in Finland in 1987 and 2007 [reduced from 13 to 8.3 g/day in men, and from 11 to 7 g/day in women ( $n \sim 1000$  individuals)]. A similar trend was observed for the voluntary salt labelling and limits in Denmark between 2006 and 2010: reduced from 10.7 to 9.9 g/day in men, and from 7.5 to 7.0 g/day in women (sample size not reported).

**Education** was only documented in the review by Backholer *et al.*<sup>35</sup> (high quality). The review found contradictory results from two studies on American state SSB taxes. One found no relationship between variations in taxes and BMI in adolescents by level of parental education; the other reported a significant reduction in BMI following a 1% increase in SSB tax rate among both adults who had a high-school diploma (0.0031  $\text{kg/m}^2$ ) or a college diploma (0.0076  $\text{kg/m}^2$ ).

**Socioeconomic status** was documented in three high-quality systematic reviews. Teng *et al.*<sup>45</sup> reported that effects of taxes on non-essential food in both Mexico (on purchases of taxed food) and Hungary (on consumption of taxed sugar-added food) were greatest in low-socioeconomic households. Impact

**TABLE 7** Direction of effects for specific population groups by equity domain and policy governance approach (eligible real-world policies only)

Equity domains	Direction of effect (or association) by comparison of governance approaches ( <i>k</i> = <i>N</i> studies, <i>n</i> = <i>N</i> participants; quality)	Governance approaches and policies (countries)
Place	NR	
Race, ethnicity, culture, language	△ for non-Hispanic white adults (trans-fat in blood) ( <i>k</i> = 1, <i>n</i> = 229–292 in 2000–9); (++)	R trans-fat limits and M labels (USA) <sup>38</sup>
	▲ for African American (SSB intake); ( <i>k</i> = 1, <i>n</i> = 7300); (+)	R State SSB taxes (USA) <sup>36</sup>
	Unclear (BMI); (+)	R State SSB taxes (USA) <sup>36</sup>
Occupation	NR	
Gender	▲ for women (BMI); ( <i>k</i> = 2, <i>n</i> = 4,658,255); (+)	R Tax on SSBs and fast-food restaurants (USA) <sup>36</sup>
	<b>Mixed governance:</b> ▲ for men and women (salt intake); ( <i>k</i> = 1, <i>n</i> = 1206–909 in 1979–2002); (-)	R salt labelling + V reformulation + media campaign (Finland) <sup>50</sup>
	<b>Voluntary:</b> ▲ for men and women (salt intake); ( <i>k</i> = 1, <i>n</i> = NR in 2006–10); (-)	V salt targets + V FOP logo + education (Denmark) <sup>50</sup>
Religion	NR	
Education	◀▶ BMI ( <i>k</i> = 2, <i>n</i> = 2,863,095); (++)	SSB taxes (USA) <sup>36</sup>
	▲ for low-income (purchases of taxed foods) ( <i>k</i> = 1, <i>n</i> = 6089 households); (++)	R Tax on non-essential food (Mexico) <sup>45</sup>
	▲ for low-income (intake of taxed sugar-added foods) ( <i>k</i> = 1, <i>n</i> ~ 10,000 households); (++)	R Tax on non-essential food (Hungary) <sup>45</sup>
	◀▶ (SSB/calorie intake) ( <i>k</i> = 2, <i>n</i> = 9953 households + 7300 children); (++)	SSB taxes (Mexico, USA) <sup>45</sup>
	◀▶ (purchases/sales SSBs) ( <i>k</i> = 6, <i>n</i> = 96,884 households + 284,464 sales in Spain); (++)	SSB taxes (Chile, Mexico, Spain) <sup>45</sup>
	▲ households in lowest income quartile (likely for the consumption of unprocessed sugar or sugar-added food) ( <i>k</i> = 1, <i>n</i> = 40,210 households); (++)	Tax on non-essential foods (Hungary) <sup>44</sup>
	◀▶ ( <i>k</i> = 2; <i>n</i> = 2,716,288 participants); (++)	SSB taxes (USA) <sup>35</sup>
Social capital	NR	
Age	▲ adult vs. children (declined in both; SSB intake) ( <i>k</i> = 5, <i>n</i> unclear); (++)	SSB taxes (USA) <sup>45</sup>
	▲ for middle-aged and older (BMI); ( <i>k</i> = 1, <i>n</i> = 2,709,422); (+)	State SSB taxes (USA) <sup>36</sup>
	▲ for children low-income (SSB intake); ( <i>k</i> = 1, <i>n</i> = 7414); (+)	SSB state taxes (USA) <sup>36</sup>
	◁▷ children's menus (calorie and other nutrients) ( <i>k</i> = 3, <i>n</i> = 291 restaurants); (+)	R calorie menu labelling (Australia, USA) <sup>49</sup>
Disability	NR	

NR, not reported; R, regulatory; RV, mixed governance; V, voluntary.

#### Notes

*k* = *N* studies referring to the outcome; *n* = total *N* participants. Symbols: The triangles illustrate the overall direction of effect or association on health and health-related outcomes independently from statistical significance. ▲ = desirable effect, ▼ = undesirable effect, ◀▶ = inconsistent effect. Large arrow ▲ > 300 sample size; medium arrow △ 50–300; small arrow ▲ < 50. Quality rating: (-) = assessed as low quality; (+) = assessed as acceptable quality; (++) = assessed as high quality. Sample size: The final sample size was selected for studies that include more than one data collection.

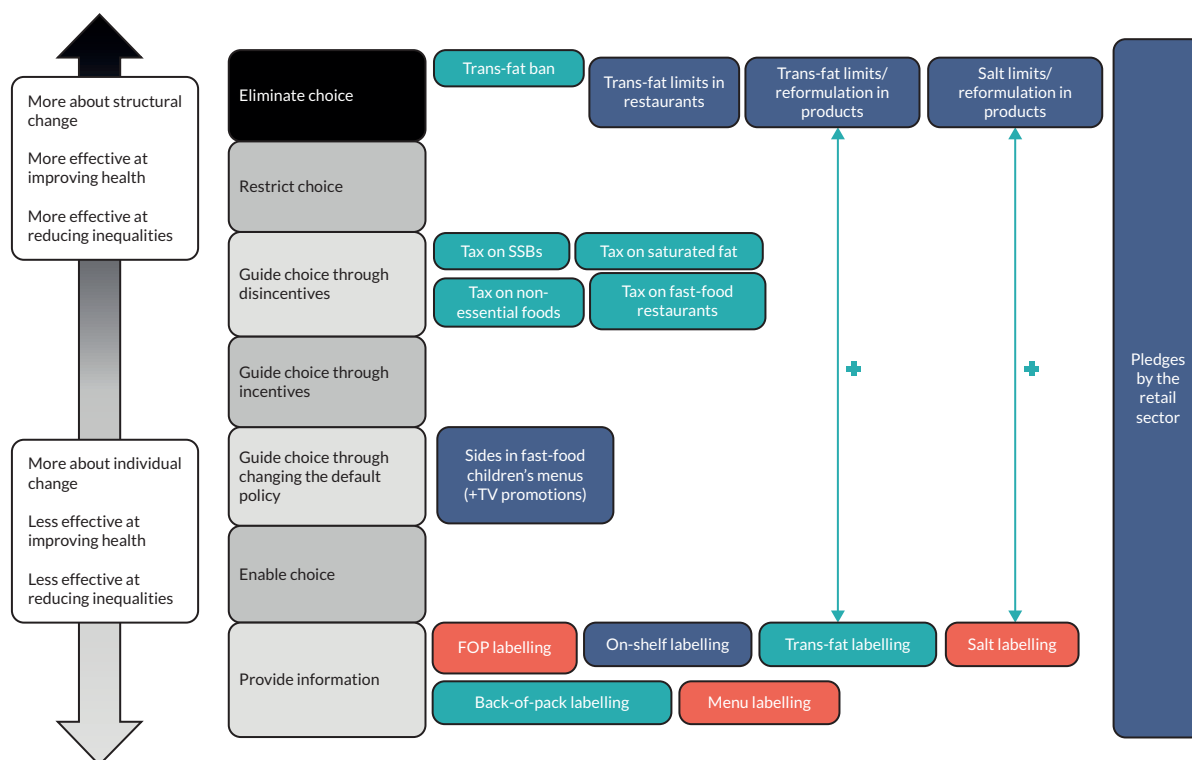
of SSB taxes on SSB and calorie intake was mixed in Mexico and the USA, and were mixed as well for purchases and sales of SSBs in Mexico, the USA and Spain ( $n = 6$  studies). Pfänder *et al.*<sup>44</sup> reported that the Hungarian Tax on non-essential food was most effective in the lowest income quartile (likely for the consumption of unprocessed sugar or sugar-added food). Backholer *et al.*<sup>35</sup> mentioned, on the one hand, no association between variations in American state SSB taxes and BMI in children from low-income families and on the other hand, a significant BMI reduction in both low-income ( $0.015 \text{ kg/m}^2$ ) and high-income adults ( $0.008 \text{ kg/m}^2$ ).

**Age** was documented in three systematic reviews. In a meta-analysis, Teng *et al.*<sup>45</sup> (high quality) compared the effect of American state SSB taxes on SSB intake between children and adults and found no statistical difference (it reduced by 6.4% in adults and by 7.7% in children,  $p = 0.91$ , five studies in the USA). In Alagiyawanna *et al.*<sup>36</sup> (acceptable quality), one study found that American state SSB taxes had a greater effect on BMI in middle-age and older people, while in another children from low-income families consumed 0.142 SSB less by week following a 1% increase in a SSB tax rate (statistically significant but arguably negligible). Lastly, in Rincón-Gallardo *et al.*,<sup>49</sup> effects from three studies ( $n = 291$  restaurants) were inconsistent on whether regulatory menu labelling improve the nutrition composition of children's menus. The first study, in the USA, found that mean calorie content of new items was lower than in the previous menus. In a second American study, mean energy content had reduced in quick-service chains by 40 calories and increased in upscale restaurants by 46 calories (no precision estimates). The third study, in Australia, found that mean energy, saturated fat, sodium and sugar had reduced by serving for some menus but had increased in others (no precision estimate).

#### **Direction of effects by intervention level**

Four systematic reviews of various quality ratings assessed different types of policy interventions and/or commented on their effectiveness by considering the level of restriction of choice or degree of structural change. Hillier-Brown *et al.*<sup>41</sup> (high quality) used the Nuffield intervention ladder<sup>53</sup> to analyse policies aiming to improve takeaway meals. They found that policies restricting choices or manipulating price were more effective than those only providing information or enabling choice. They suggested that 'the level of intrusiveness' played a greater role than the type of policy itself. Downs *et al.*<sup>48</sup> (acceptable quality) came to similar conclusions for trans-fats policies. They found that limits, and particularly bans, were the most effective for reducing trans-fat levels in the food supply and diet while labelling had a lesser impact and was uneven across product categories. Hyseni *et al.*<sup>38</sup> (low quality) employed the upstream versus downstream classification, or population versus targeted interventions to assess salt-related policies. They concluded that 'comprehensive multicomponent strategies involving upstream population-wide policies (regulation, regulatory reformulation and food labelling)' had a much greater impact than downstream interventions targeting individuals (e.g. dietary counselling, media campaigns alone). They did not differentiate intervention levels within the 'upstream' category but highlighted the potential of combining interventions, such as labelling with salt targets. Lastly, Sisnowski *et al.*<sup>39</sup> (acceptable quality) concluded that regulations applied in isolation could improve the food environment and other distal outcomes but not dietary intake so far; yet they mentioned the promising results of taxation, which were published after their systematic review. Like Hyseni *et al.*,<sup>50</sup> they recommended combining interventions.

To explore the policies assessed in the overview of reviews further, we classified them by intervention levels and identified those with several components using the Nuffield intervention ladder.<sup>53</sup> However, since this project focused on interventions modifying the food environment, we did not document education programmes and public campaigns. As shown in [Figure 12](#), most of the interventions assessed eliminated choice (by eliminating a nutrient or reducing its level), guided choices through disincentives (taxation) or provided information (labelling). One guided choice by changing the default (sides offered in children's meals) while pledges by the retail sector encompassed several levels, from labelling to eliminating choice (reformulation).



**FIGURE 12** Types of policies assessed in the systematic reviews by governance approach and intervention level using the Nuffield intervention ladder. Black and grey: the Nuffield Intervention ladder.<sup>53</sup> Blue: regulatory. Green: voluntary. Orange: mixed (both regulatory and voluntary components). Line with '+' sign: multicomponent intervention.

Furthermore, while some limited evidence suggests that it can help the public to make informed choices, has the support from the population, and can encourage food reformulation, Downs *et al.* and Hyseni *et al.*<sup>38,48</sup> highlighted that they are likely to increase inequalities for two reasons; (1) products can continue to contain a high amount of salt, sugar and fat, and low fibres, FV, especially cheaper options, so people from low SES are more likely to continue to consume them; (2) whether labels are regulatory or voluntary, customers need to understand and use them, which requires a certain health literacy level. By completely eliminating trans-fats, bans were identified as not only the most effective approach for reducing trans-fat consumption but also the most equitable. Therefore, the level of intervention, or extent of structural changes involved, potentially plays a role in both policy effectiveness and the reduction of inequalities. Yet, structural interventions also have their own challenges politically. Sisnowski *et al.*<sup>39</sup> mentioned that government policies can be softened to 'appease industry and political opponents', for instance, by bringing the focus on individual behaviours or reducing the extent of structural changes involved, thus misaligning them with public health recommendations.

## Conclusions

Overall, the results suggest that, except for salt and saturated fat-related taxes, for which evidence is limited to few real-world initiatives including some with particularly narrow scopes, most regulatory approaches designed to improve health, consumer behaviour (e.g. food intake, purchases), and food environment outcomes were evaluated as effective. These mainly consisted of trans-fat bans, taxes on SSBs and non-essential foods (except for salt intake), and FOPL. Effects for voluntary approaches by public and private actors were also generally positive for salt and trans-fat reformulation (but regulatory trans-fat bans were more promising). Effects of labelling on products and supermarket shelves, and of changing defaults in children's menus in restaurants were also generally positive, although limited to

one or two studies each, mainly from the USA. Results for voluntary menu labelling and multicomponent commitments by large retail chains were mixed. The findings stratified by PROGRESS-Plus categories indicate a lack of reporting of outcomes in systematic reviews for population groups that are prone to health inequalities: overall, evidence on equity is patchy, incomplete, mainly inconsistent, and largely relies on single studies (although some evaluations had large samples) rather than aggregated bodies of evidence.



# Chapter 5 Systematic review on the effectiveness of public–private partnerships to improve food environments and population diet

## Introduction

This systematic review reports the evidence of effectiveness of PPPs to improve food environments and population diet, complementing the overview of reviews (see [Chapter 4](#)), which did not report on PPPs.

## Methods

### *Literature search and eligibility criteria*

This systematic review used the primary studies from the systematic evidence map that assessed the effectiveness of a PPP (see [Chapter 3, Figure 8](#)). To be considered as such, policies had to either be clearly labelled as a PPP or involve collaboration between at least one public and one private actor. Studies of any design (including document analyses) were considered if they assessed effects on the food environment, human behaviour or health, or the economy; or if they assessed the content or progress of the policy itself. Results had to be provided for PPPs separately, that is those aggregated with findings for other governance approaches were excluded.

### *Data extraction*

In addition to the policy and evaluation characteristics extracted for the systematic evidence map (see [Chapter 2](#)), in a standardised extraction form we documented the following information: policy and study objectives, the policy leader and other main actors involved, implementation and data collection dates, study design, samples' characteristics, results about effects including policy content, project or adherence as well as effect size and precision estimates, and potential competing interests of study authors using information from the declaration of competing interests, funding sources and authors' affiliations. Data were extracted by one reviewer (CK, GB) and checked by another (CK, GB, JB, LB).

### *Study quality appraisal*

Study quality was assessed using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies. Studies were rated on seven domains and rated overall as having a low, moderate, high or unclear quality. Each item was assessed by one reviewer and checked by two others (JB, GB, LB). Disagreements were discussed until reaching consensus. Details about the tool are provided in [Chapter 2](#) and [Appendix 4, Table 26](#). This includes specifications for the document analyses. For appraising the representativeness of the sample, we considered whether the literature search was comprehensive; for the sample size justification, we considered the variety of information sources used taking into account the study aim; we considered the 'analytical methods' rather than 'statistical tests' only; questions relating to ascertainment of exposure and confounders were deemed non-applicable (because the documents were about the policies themselves, and there is currently no guidance for assessing confounders for such studies including if this is relevant). For studies involving human participants, both the original question about non-response and the modified guidance about missing data were applied. For appraising ascertainment to exposure, when participation status in a policy was unclear in a study, we compared the number of participants in the policy in general to those mentioned in the study in order to get a sense of whether participation status was up to date and likely to have remained relatively stable during the study or not.

### Data synthesis

Due to high heterogeneity in the outcomes assessed, data were synthesised narratively by considering the general direction of effect by type of participants (human, environment, documents) and policy as well as overall study quality.

## Findings

Of the 18 primary studies assessing the effectiveness of a PPP, 1 was excluded for not focusing on PPPs separately, leaving 17 studies in the systematic review.

### Public-private partnership characteristics

Seven PPPs implemented in four countries between 2007 and 2016 were assessed ([Table 8](#)). Nine of the studies were about the FHD in Australia. Two of these also assessed the Australian Division of World Action on Salt and Health (AWASH) voluntary programme, including one together with the New Zealand Heart Foundation (NZHF) voluntary programme (the three policies overlapped in time).<sup>54,55</sup> Four studies evaluated the Public Health RD in England, UK,<sup>13,56-58</sup> and another four investigated PPPs in the USA (the HWC twice,<sup>51,59</sup> Choose Healthy Now (CHN)<sup>60</sup> and the Strong4Life School Nutrition Program<sup>61</sup>). All studies in Australia and New Zealand ( $n = 9$ ) focused on salt reformulation, two of which also assessed interventions to improve sugar, fat, fibres, fruit, vegetables content and portion size. In the other countries, the policy categories based on the NOURISHING framework ranged from menu and on-shelf labelling to food reformulation (calories or fat), the retail and catering sectors, and schools.

### Study characteristics

Two studies were cross-sectional,<sup>57,60</sup> 10 were repeat cross-sectional (7 pre-post,<sup>51,54,58,59,61-63</sup> 3 post-post<sup>55,64,65</sup>), 1 a time-series analysis<sup>59</sup> and 5 were policy document analyses.<sup>13,56,66-68</sup> Five had humans as study participants (directly or by using purchases or sales data),<sup>13,56,66-68</sup> six assessed food items, one assessed display of calorie labelling and five assessed documents. The human studies were about the USA and the UK, the studies of products were about Australia and New Zealand, the study of labelling practices was about the UK, and the policy document analyses were about Australia and the UK. All policies were assessed between 2 and 8 years after their introduction, giving time for the participants to implement the changes. Sample size of participant groups ranged from 16 restaurant chains (sample size can be especially small when studies used the number of companies as a unit of analysis, which is limited) to more than 2500 products. All studies of food products focused on salt content and were from Australia (with one on New Zealand as well). Two studies involving humans assessed the purchases and sales of calories, one trans-fat intake, and two looked at awareness, belief and/or self-efficacy relating to the policy. Two of the five document investigated achievements while the remaining three focused on the policy process, for instance whether the PPP encouraged participants to do more than what they were already doing, whether the actions they commit on are likely to be effective based on evidence, and whether they document progress and make it a priority.

### Quality appraisal

Nine of the 17 studies were rated as having a low quality overall, 3 as moderate, 3 as high and 2 as unclear ([Tables 9-11](#)). Six of the nine studies about Australia were given a 'low' rating, whereas the three studies rated 'high' were policy document analyses. The main reason for an overall low quality was the lack of control group (which was not applicable to document analyses), which highly increased the risk of bias. Two studies involving humans only included people exposed to the PPP, and five studies of humans or products combined data for both PPP participants and NPs together, making it difficult to determine whether the effect was due to the PPP or not. Nevertheless, of the latter five, three were about the FHD in Australia, where a high proportion of products on the market were part of the PPP. For instance, Trevena *et al.* (2014)<sup>62,64</sup> noted that about 95% of the market share of processed meats, 85% of pasta sauces, 80% of bread products and 60% of breakfast cereals were from participants in the FHD. Changes (or lack of changes) in these products overall are likely to be at least partly due to changes (or lack of) in participating products in the PPP.

TABLE 8 Public-private partnership characteristics<sup>a</sup> (n = 7)

PPP name	Policy categories assessed	PPP description and objectives	Implement. (I) and Eval. E years	PPP lead and partners
<b>Australia (AUS)</b>				
The AWASH voluntary programme (AWASH) <sup>54,55</sup>	I-Reformulation by manufacturers (salt)	To reduce average population salt intake by 30% by 2025.	I: 2007 E: 2007–10	Lead: AWASH (NGO); Partners: NGOs, health and medical and food industry organisations
FHD <sup>54,55,62–68</sup>	I-Reformulation by manufacturers (salt in all studies, other nutrients and food groups in two studies)	To act on food innovation through a voluntary reformulation programme on packaged foods, consumer education and portion standardisation in order to reduce the saturated fat, added sugar, sodium and energy content, and increase the fruit, vegetable, fibre and wholegrain content of foods in order to make 'healthier' food choices more accessible to Australians. <sup>63</sup>	I: 2009 E: 2007–10	Lead: AUS government; Partners: Food industry, public health groups
<b>New Zealand</b>				
NZHF voluntary programme <sup>54</sup>	I-Reformulation by manufacturers (salt)	To engage the industry for reducing sodium content in bread. Information on targets is not available anymore.	I: 2007 E: 2007–10	Lead: NZHF (NGO); Partners: Food industry (no further details)
<b>UK</b>				
The Public Health RD, England, UK <sup>13,56–58</sup>	12-Reformulation by manufacturers (fat); N- Labelling (menu/on-shelf); A wide range of categories	The RD invited voluntary agreements across four 'networks' (food, alcohol, health at work and physical activity).	I: 2011 E: 2000–18	Lead: English Department of Health <sup>b</sup> (government); Partners: Commercial actors (n majority), NGOs
<b>USA</b>				
CHN <sup>60</sup>	S-Retail and catering sectors	To improve the healthfulness of snacks and drinks in convenience stores and snack shops. CHN nutritional criteria developed in collaboration with the Hawaii State Department of Health.	I: 2016 E: 2018	Lead: Hawaii State Department of Health; Partners: Convenience stores and snack shops
HWC <sup>51,59</sup>	I-Reformulation by manufacturers (calories)	Compared to 2007, to collectively sell 1 trillion fewer calories in the USA by 2012 and 1.5 trillion fewer by 2015 to help reduce obesity (especially childhood obesity).	I: 2008 E: 2000–12	Lead: HWCF; Partners: 16 food companies
Strong4Life School Nutrition Program <sup>61</sup>	O-Specific settings (schools)	To increase school meal participation and consumption of healthier foods in Georgia school cafeterias by better equipping school nutrition managers and staff members with skills and resources to make positive and visible changes in the cafeteria. Strategy includes sell, taste, visibility, convenience and price.	I: 2012 E: 2015	Lead: Governor of Georgia; Partners: Children's Healthcare of Atlanta (a large paediatric clinical care providers) and schools

AUS, Australia; CPG, consumer packaged goods; E, evaluation; I, implementation; NGO, non-governmental organisation; NZHF, New Zealand Heart Foundation; RTE, ready-to-eat.

a At the time of their implementation and evaluations.

b Now the Department of Health and Social Care.

**TABLE 9** Study quality of cross-sectional studies involving humans (directly and indirectly), using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies ( $n = 5$ )

Author (date)	Selection		Comparability			Outcome		Overall rating	
	Representativeness of sample size	Sample size justification	Non-response	Missing data	Ascertainment of exposure	Confounders	Assessment of outcome		Statistical methods
Beckelman <i>et al.</i> (2020) <sup>60</sup>	Low (-)	Low (-)	Low (-)	Unclear (?)	High (++) (all exposed)	Low (-) (P only)	Low (-)	High (++)	Low (-)
Hutchinson <i>et al.</i> (2018) <sup>58</sup>	High (++)	Low (-)	Unclear (?)	Unclear (?)	N/A (P and NP combined)	Low (-) (P and NP combined)	High (++)	High (++)	Low (-)
Ng <i>et al.</i> (2014) <sup>59</sup>	High (++)	High (++)	Unclear (?)	Moderate (+)	High (++)	Moderate (+)	High (++)	High (++)	Moderate (+)
Ng <i>et al.</i> (2014) <sup>51</sup>	High (++)	High (++)	Unclear (?)	High (++)	High (++)	Moderate (+)	High (++)	High (++)	Moderate (+)
Rajbhandari-Thapa <i>et al.</i> (2017) <sup>61</sup>	High (++)	Low (-)	Low (-)	Low (-)	High (++) (all exposed)	Low (-) (P only)	Low (-)	High (++)	Low (-)

N/A, not applicable; P, participants in the PPP.

**TABLE 10** Study quality of cross-sectional studies of food products, using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies ( $n = 7$ )

Author (date)	Selection		Comparability			Outcome		Overall rating
	Representativeness of sample size	Sample size	Missing data	Ascertainment of exposure	Confounders	Assessment of outcome	Statistical methods	
Christoforou <i>et al.</i> (2013) <sup>55</sup>	Moderate (+)	Unclear (?)	Unclear (?)	N/A (P and NP combined)	Low (-) (P and NP combined)	Low (-)	High (++)	Low (-)
Dunford <i>et al.</i> (2011) <sup>54</sup>	Low (-)	Unclear (?)	Unclear (?)	N/A (P and NP combined)	Low (-) (P and NP combined)	Low (-)	High (++)	Low (-)
Levi <i>et al.</i> (2018) <sup>63</sup>	Moderate (+)	High	Unclear (?)	Unclear (?)	Moderate (+)	High	High (++)	Unclear (?)
Sparks <i>et al.</i> (2018) <sup>65</sup>	Moderate (+)	Unclear (?)	Unclear (?)	N/A (P and NP combined)	Low (-) (P and NP combined)	Low (-)	High (++)	Low (-)
Trevena <i>et al.</i> (2014) <sup>62</sup>	Moderate (+)	Unclear (?)	High (++)	N/A (P and NP combined)	Low (-) (P and NP combined)	Low (-)	High (++)	Low (-)
Trevena <i>et al.</i> (2014) <sup>64</sup>	Moderate (+)	Unclear (?)	High (++)	High (++) (all exposed)	Moderate (+) <sup>a</sup>	High (++)	High (++)	Moderate (+)
Robinson <i>et al.</i> (2019) <sup>69</sup>	Moderate (+)	Unclear (?)	Unclear (?)	High (++)	Moderate (+)	Moderate (+)	Unclear (?)	Unclear (?)

N/A, not applicable; P, participants in the PPP.

a Although there was no control group, the quality was not judged 'low' because the study simply aimed at measuring whether the products included in the PPP met the targets.

**TABLE 11** Study quality of policy document analyses using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies (n = 5)

Author (date)	Selection		Missing data	Assessment of outcome	Outcome	
	Search strategy	Variety of information sources <sup>a</sup>			Analytical methods	Overall rating
Elliot <i>et al.</i> (2014) <sup>66</sup>	Low (-)	High (++)	Unclear (?)	Low (-)	Moderate (+)	Low (-)
Jones <i>et al.</i> (2016) <sup>67</sup>	High (++)	High (++)	High (++)	Low (-)	Moderate (+)	Low (-)
Lindberg <i>et al.</i> (2017) <sup>68</sup>	High (++)	High (++)	Unclear (?)	High (++)	High (++)	High (++)
Knai <i>et al.</i> (2015) <sup>56</sup>	High (++)	High (++)	High (++)	High (++)	High (++)	High (++)
Knai <i>et al.</i> (2017) <sup>13</sup>	High (++)	High (++)	Unclear (?)	High (++)	High (++)	High (++)

a Taking into account the research question.

Furthermore, justifications for sample size in studies of humans and products, and of information on non-responders in human studies were mostly judged as non-appropriate or not reported (unclear). Only seven studies reported information on missing data and how they were dealt with. Eight did not report on the number of people collecting or verifying data independently, contributing to a low quality for assessment of outcomes since such information missing likely means that only one person was involved. Quality of the analytical methods was generally rated high. All policy document analyses were judged to have sufficiently diverse sources of information.

### Effects of public-private partnerships

Table 12 presents a summary of the study characteristics and key findings. Six studies assessed changes in salt content in Australia, all relating to the FHD and AWASH programme, which took place concomitantly. Findings pointed towards no or mixed effects overall, with four studies (three of low quality, one moderate) showing mixed or no effects, and two studies on the FHD (one low and one unclear quality) showed improvements overall. On the one hand, Levi *et al.* (2018)<sup>63</sup> (unclear study quality) found that sodium levels in soups had fallen by 6% between 2011 and 2014. Sparks *et al.* (2018)<sup>65</sup> (low quality) assessed sodium levels in processed meats between 2010 and 2017. They reported an 11% reduction in median sodium levels in the processed meats that had a salt target versus no change in those without a target. However, by category of products they reported mixed results with significant reductions in bacon, ham/cured meat and wet savoury pasties ( $p < 0.001$ ,  $p = 0.012$  and  $p = 0.006$ , respectively) and significant no change in emulsified luncheon meats ( $p = 0.363$  and dry savoury pasties ( $p = 0.111$ ). On the other hand, Dunford *et al.* (2011)<sup>54</sup> (low quality) found that while the proportion of breads meeting the national salt target increased from 29% in 2007 to 50% in 2010, the mean sodium content did not change (434 mg/100 g in 2007 vs. 435 mg/100 g in 2010). Trevena *et al.* (2014)<sup>62</sup> (low quality) noted no significant difference in the mean sodium content of pasta sauces (451 mg/100 g in 2008 vs. 423 mg/100 g in 2011;  $p = 0.016$ ), cautioning the need to reformulate sauce products well beyond the FHD commitment. Another study by the same authors<sup>64</sup> (moderate quality) examined breads, ready-to-eat breakfast cereals and processed meats. They reported significant reductions of sodium in bread (unlike Dunford *et al.*) and breakfast products, and some reduction in processed meats, though with no apparent difference between participating brands, calling into question whether the partnership drove the reduction. Christoforou *et al.* (2013)<sup>55</sup> (low quality) set out to report on changes in sodium levels in the ready meal market between 2008 and 2011. They concluded that the voluntary efforts of industry to reduce sodium levels of these foods over 4 years yielded a reduction of less than 1%. They ascribed this to the lack of co-ordination across industry and a failure of the Australian government to take leadership in improving the quality of the food supply.

TABLE 12 Public-private partnership study characteristics and results (n = 17)

Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
<b>Australia and New Zealand (n = 9)</b>						
Dunford <i>et al.</i> (2011) <sup>54</sup> NZHF and AWASH voluntary programmes Low (-)	To define the effectiveness of recent efforts by AWASH, and the NZHF to reduce Na levels in breads in AUS and NZ.	Repeat cross-sectional (pre-post) (2007 and 2010)	Packaged sliced bread labels (n = 157 in 2007, n = 167 in 2010) sold in AUS and NZ supermarkets.	Mean sodium (Na) content per 100 g, compared overall, by bread type, by manufacturer, and between nations.	From 2007 to 2010, the mean Na content of bread products in AUS did not change: 434 mg/100 g in 2007 vs. 435 mg/100 g in 2010; 7% reduction in NZ: 469 mg/100 g and 439 mg/100 g. The proportion of AUS breads meeting the national target increased from 29% in 2007 to 50% in 2010; the proportion of NZ breads meeting the national target increased from 49% in 2007 to 90% in 2010. Differences between the results achieved by different companies.	Authors affiliated to AWASH
Christoforou <i>et al.</i> (2013) <sup>55</sup> AWASH programme and FHD Low (-)	To define changes in sodium levels within the ready meal market in AUS between 2008 and 2011.	Repeat cross-sectional (post-post) (2008, 2009, 2010, 2011)	Ready meal products: n = 107 (2008), 313 (2009), 219 (2010), 265 (2011). Labels collected from two major and three smaller stores (together control 96% of AUS grocery market).	Mean Na content per 100 g. Compared overall, by ready meal type, and by manufacturer.	From 2008 to 2011, overall Na content of ready meal products was largely unchanged (279 → 277 mg). The proportion of AUS ready meals meeting the AWASH target fell slightly over the study period (59–57%). Differences between the results achieved by different companies.	Authors affiliated to AWASH
Trevena <i>et al.</i> (2014) <sup>62</sup> FHD Low (-)	To assess the change in Na content of AUS pasta sauces between 2008 and 2011. (FHD) To project the mean Na content of products in 2014, comparing to the 2012 UK Na target for pasta sauce (330 mg/100 g).	Repeat cross-sectional (post-post) (2008 and 2011)	Pasta sauces sold in five supermarkets in Sydney, AUS (124 pasta sauces in 2008 and 187 in 2011).	Mean Na content. Manufacturers grouped by type according to % volume share in 2009 (supermarket own label; leading manufacturers; other manufacturers). Na content assessed from product labels.	Mean Na content was not sig different between 2008 and 2011 (451 mg/100 g vs. 423 mg/100 g; p = 0.16). Projected means exceeded 2012 UK target. Scenario 1: 381 mg/100 g; scenario 2: 375 mg/100 g. 22% reduction needed from 2011 levels to meet target.	Authors affiliated to AWASH

continued

**TABLE 12** Public-private partnership study characteristics and results ( $n = 17$ ) (continued)

Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
Trevena <i>et al.</i> (2014) <sup>64</sup> FHD Moderate (+)	To assess Na reduction targets for breads, ready-to-eat breakfast cereals and processed meats, and quantify the magnitude of any changes in Na content and to explore whether changes differed by manufacturer or product category. (FHD)	Repeat cross-sectional (post-post) (July and September, 2010-3)	Packaged foods in AUS supermarkets ( $n = 1849$ in total); bread products, $n = 885$ ; breakfast cereals, $n = 532$ ; bacon/ham/cured meat, $n = 387$ ; emulsified meat, $n = 45$ ; bread: 2010, P (FHD participant) products, $n = 145$ (84%); 2013, P products, $n = 177$ (66%); bacon/ham/cured meat: 2010, P, $n = 83$ , (92%); 2013, P, $n = 98$ (88%); emulsified meat: 2010, P, $n = 9$ (69%); 2013, $n = 7$ (64%); breakfast cereals; 2010, P, $n = 86$ (70%); 2013, $n = 107$ (67%). Data from product labels.	Mean Na content. Products included bread products; value added products; ready-to-eat breakfast cereals; and processed meats (bacon/ham/cured meat and emulsified meat).	Mean Na content of bread products and breakfast cereals sig reduced from 454 to 415 mg/100 g and 316 to 237 mg/100 g ( $p < 0.001$ ), respectively. Sig increase in bread products reaching target (42-67%) ( $p < 0.005$ ). Smaller but still sig reduction in Na in cured meats, bacon, ham (1215-1114 mg/100 g, $p = 0.001$ ). No apparent difference in Na reductions between P and P brands.	Authors affiliated to AWASH
Elliot <i>et al.</i> (2014) <sup>66</sup> FHD Low (-)	To evaluate whether the FHD, is having an impact on reducing premature death and disability caused by unhealthy diet in AUS.	Policy document analysis adoption, (October 2009 to September 2013)	Data on processed foods obtained from a food composition database. Data from the FHD website, media releases, communiqués and e-newsletters.	Assessment of the FHD achievements (goals, targets, actions and health outcomes) by adopting the RE-AIM framework (reach, efficacy, implementation and maintenance. Na, saturated fat, added sugar, energy, fibre, whole grains, fruit/vegetable content, portion size.	Data available to evaluate the FHD was limited. Several reports on achievements were missing. None of the targets were due to have been met by September 2013. Eight product categories had set Na targets. One product category had saturated fat targets, and only two product categories had portion size targets set. Engagement of relevant companies across product categories ranges from 60% to 100%.	Authors affiliated to AWASH



Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
Jones <i>et al.</i> (2016) <sup>67</sup> FHD Low (-)	To evaluate FHD over 6 years and to use the findings to develop recommendations for the success of the new HFP.	Policy document analysis (October 2013–November 2015)	137 areas of possible FHD action. Data from FHD website, media releases, communiqués, e-newsletters, materials released under freedom-of-info, and Parliamentary Hansard.	Assessment of the FHD (goals, targets, actions and health outcomes) by adopting the RE-AIM framework (reach, efficacy, adoption, implementation and maintenance).	Limited data is available to assess achievements. Not info about progress towards milestones published since October 2011.	No competing interests declared
Lindberg <i>et al.</i> (2017) <sup>68</sup> FHD High (++)	To explore if Australia's largest food manufacturers positive (nutrition) changes to their product portfolios as disclosed in their public policies, priorities, and communications; To assess if salt reduction a priority for processed food manufacturers.	Policy document analysis (2010–May 2017)	Grey literature by 33 Australian food manufacturers producing product lines of relevance to salt-reduction included.	Evidence of priority and progress for the FHD salt targets.	All ( $n = 33$ ) manufacturers state nutrition and healthy eating as part of their policies, protocols and priorities. Many ( $n = 16$ ) manufacturers provide no evidence or documentation of reducing salt in their products. Half of the sample ( $n = 17$ ) describe some salt reduction activities, but the scale and efficacy of these changes is unclear.	No competing interests declared
Levi <i>et al.</i> (2018) <sup>63</sup> FHD Unclear (?)	To examine the food industry's progress and compliance with the FHD Na reduction targets for soup.	Repeat cross-sectional (pre–post) (between August and December in 2011, 2012, 2013, 2014)	1153 dry, canned and chilled soups from the same four grocery retail stores in Sydney, Australia. [Products in PPP in 2014: 68 (77%) dry and 125 (59%) wet soups from 5 companies; Products not in PPP in 2014: 20 dry and 87 wet]. N companies (NR) Nutrition info from the George Institute Branded Food Composition Database.	Na content of 'wet and condensed' and of 'dry' soups 'as consumed'.	6% reduction in Na levels in soups overall from 2011 to 2014 ( $p = 0.002$ ). Sig reductions in Na observed in P products ( $p < 0.05$ ). Not observed for NP products. In 2014, 67% of dry soups and 75% of wet soups met the Na reduction targets. In 2014, the number of dry soups from P that met the targets compared to when they entered the market sig increased ( $p = < 0.001$ ). The same pattern was not witnessed with NP (some non-sig reductions were noted). For wet products, there was no sig change in the proportion of manufacturers meeting the target between 2011 and 2014 by participation status.	No competing interests declared

continued

**TABLE 12** Public-private partnership study characteristics and results (*n* = 17) (*continued*)

Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
Sparks <i>et al.</i> (2018) <sup>65</sup> FHD Low (-)	To assess the median Na sodium levels of 2510 processed meat products, including bacon and sausages, available in major Australian supermarkets in 2010, 2013, 2015 and 2017, and assessed changes over time.	Repeat cross-sectional (post-post) (2010, 2013, 2015 and 2017)	2510 processed meat products in four major supermarkets in Australia 2010: 181 (43%) P; 2017: 236 (35%) P. Nutrition data from the Australian FoodSwitch database.	Na content of processed meat, of which five product categories have targets (P): bacon, ham/cured meat products, emulsified luncheon meats, wet savoury pasties and dry savoury pasties.	Median Na of P processed meats reduced by 11% ( $p < 0.001$ ) vs. no change in NP (median difference 6%, $p = 0.450$ ). It was 1010 mg/100g in 2010 vs. 898 mg/100g in 2017 for P and 765 mg/100g in 2010 vs. and 717 mg/100g in 2017 for all processed meat. A higher proportion of bacon, ham/cured meat products and wet savoury pasties met the targets between 2010 and 2017 ( $p < 0.001$ , $p = 0.012$ and $p = 0.006$ , respectively) while there were no change for emulsified luncheon meats ( $p = 0.363$ and dry savoury pasties ( $p = 0.111$ ).	Declared affiliations with WHO Collaborating Centre on Population Salt Reduction
<b>UK (<i>n</i> = 4)</b>						
Knai <i>et al.</i> (2015) <sup>56</sup> Public Health RD High (++)	To analyse the evidence of the effectiveness of the specific interventions in the RD pledges and the likelihood that the pledges have brought about actions among organisations that would not otherwise have taken place.	Policy document analysis (synthesis of RD website reports using evidence on effectiveness from an overview of reviews) (At implementation: 2011 and post-impl.: 2015)	Six RD pledges, 17 evidence reviews. Comparative analysis of published progress reports and publicly available data on RD website.	Likely effectiveness and added value of pledges. Explored changes over time, and compared to what was originally set out in delivery plans.	Progress reports were very inconsistently provided on the RD website and mostly unavailable. The most common intervention in the salt reduction pledge involved reformulation activities (46%). Reformulation of recipes and menus was the most commonly listed intervention in the calorie reduction pledge (64%). Some of the RD food interventions could be effective, if fully implemented. Most interventions reported by organisations seemed either clearly (37%) or possibly (37%) already underway.	No competing interests declared. Funding: NIHR Policy Research Unit

Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
Knai <i>et al.</i> (2017) <sup>13</sup> <i>Public Health RD</i> High (++)	To evaluate the Public Health RD effectiveness at encouraging signatory organisations to remove artificially produced TFAs from their products.	Policy document analysis (2015)	Publicly available data in the progress reports of the signatory organisations to the pledge confirming non-use of TFAs (n = 90).	Compared progress reports against what had been originally set by organisations in their delivery plans.	91% of the signatory organisations (n = 82) had already removed TFAs or had removal of TFAs underway before the RD started. 9% (n = 11) signatory organisations signed up to part 2 of the pledge (pledging artificial TFA removal). Five were not in a position to reformulate food products at the point of manufacture, some reported replacing products.	No competing interests declared. Funding: NIHR Policy Research Program
Hutchinson <i>et al.</i> (2018) <sup>58</sup> <i>Public Health RD</i> Low (-)	To explore whether voluntary reformulation results in different intakes of TFAs among socioeconomic groups.	Repeat cross-sectional (pre-post) (pre-reformulation: 2000-1 vs. postre-formulation: 2010-1 to 2011-2)	UK adults aged 19-64 years from the UK National Diet and Nutrition Surveys (NDNS) Pre-reformulation: n = 1724; Postreformulation: n = 848 Food intake collected by 7-day weighed records pre-ref and 4-day diaries postref.	TFA intake pre- and postvoluntary reformulation with comparisons between high and low TFA consumers.	Pre-ref 57% of adults exceeded the WHO TFA intake limit, compared with 2.5% postref. Pre-ref: high TFA intake associated with lower income, lower education and long-term illness; Artificial TFA's prominent. Postref: people with higher incomes 2.5-3.3 times more likely to be top 10% consumers; ruminant TFAs prominent.	Affiliation to WHO Funding: WHO

continued

**TABLE 12** Public-private partnership study characteristics and results (n = 17) (continued)

Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
Robinson <i>et al.</i> (2019) <sup>57</sup> <i>Public Health RD Unclear (?)</i>	<p>Threefold aims:</p> <ol style="list-style-type: none"> <li>To examine the proportion of major UK restaurant (fast-food and full-service) and takeaway chains that provide kcal info at point of choice and if current practices comply with the RD rec.</li> <li>To examine the adequateness of kcal labelling practises among eligible chains that also signed the RD (2011) kcal labelling pledge.</li> <li>To explore how common it was for chains not to provide instore kcal info but have info available on their websites.</li> </ol>	Cross-sectional (post, once) August 2018	<p>Food and beverage items from 104 large chains (16 P; 88 NP)</p> <p>Full-service restaurant chains (n = 58)</p> <p>Takeaway or fast-food chains (n = 22)</p> <p>Coffee shops (n = 20)</p> <p>Supermarket chains (n = 4)</p> <p>Verified by contacting companies, reviewing websites and conducting some physical audits.</p>	Presence of calorie labelling and adherence to policy guidelines.	<p>Of the 104 chains, 18 displayed calorie labelling in stores: 12 (67%) of participants, and 6 (7%) of NPs.</p> <p>None fulfilled all seven recommended labelling criteria.</p> <p>Only one P and two NP chains provided calorie labelling for all items sold.</p> <p>43/86 (50%) of the chains that did not provide in store kcal labelling had product kcal info on their websites or were able to provide this info on request.</p>	<p>Declared prior funding from American Beverage Association and Unilever;</p> <p>Affiliations: university and NR</p>

Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
<b>USA (n = 4)</b>						
Ng <i>et al.</i> (2014) sales <sup>51</sup> HWCF Moderate (+)	To evaluate the HWCF companies' collective change in total calorie sales between 2007 and 2012 and to identify which food and beverage categories were major sources of the reductions or increases in calories sold.	Time-series analysis (pre-post) (2007 and 2012)	Calories sold from consumer packaged goods sales data from mass merchandisers and convenience stores (2012 only + nutrition info from Nielsen Scantrak data, Nutrition Fact Label data from Gladson, Mintel GNPD, Datamonitor PLA).	Calories in food and beverages sold.	Total calories sold by the HWCF companies fell from 60.4 trillion in 2007 to 54 trillion in 2012 – a decrease of 6.4 trillion calories (or -10.6%) over the 5-year pledge period. CPG caloric sales (all brands) fell from 1548 to 1449 kcal/capita/day between 2007 and 2012. With an average decline of 78 kcal/capita/day from P brands and an average of 22 kcal from NP brands. Absolute caloric sales from retailers' private label products essentially did not change. Reductions from HWCF brands came primarily from sweets and snacks (21 kcal); grain products (17 kcal) such as RTE cereal and granolas; fats and oils; sauces and condiments (15 kcal); beverages (14 kcal), particularly carbonated soft drinks (7 kcal); and shelf-stable FV drinks/juices (5 kcal).	Declared prior funding from Nestlé, Kraft and Gerber Foods
Ng <i>et al.</i> (2014) purchases <sup>59</sup> HWCF Moderate (+)	To assess the total CPG calories purchased per capita per day by households. To compare HWCF name-brand products with non-HWCF name-brand products and private label products, and using a counterfactual based on pre-pledge trends, see if the HWCF contributed to a reduction in calories purchased.	Repeat cross-sectional (pre-post) (2000–12)	CPG purchase data (food and beverages) Nutrition info from Nielsen Homescan data, Nutrition Fact Label data from Gladson, Mintel GNPD, Datamonitor PLA.	Calories purchased per capita per day by households.	Unadjusted annualised caloric sales of CPG declined faster in the post pledge (2008–12) period than pre-pledge (2000–7). Private labels saw sig declines postpledge. HWCF products saw the greatest absolute and relative declines in calories. The rate was statistically steeper postpledge. Non-HWCF calorie declines across private label products slowed postpledge, not sig. A sig ( $p < 0.001$ ) reduction in CPG calories between 2007 and 2012 of -206 kcal/capita/day, -96 kcal from HWCF products, -63 kcal from non-HWCF and -47 from private labels. Postpledge reductions were greater than pre-pledge trends (counterfactual).	Declared prior funding by Nestlé's Water USA received a gift from Kraft and Gerber Foods to cofund a national dietary survey

continued

**TABLE 12** Public-private partnership study characteristics and results (*n* = 17) (*continued*)

Lead author (year) PPP; study quality	Study aim	Study design (data collection dates)	Sample and data sources	Outcomes assessed	Results	Reported competing interests
Rajbhandari-Thapa (2017) <sup>61</sup> <i>Strong4Life School Nutrition Program</i> Low (-)	To assess the effect of the Strong4Life School Nutrition Program on (1) participant knowledge of evidence-based strategies for improving school cafeteria and student school meal practices and self-confidence in their ability to make changes, (2) the school cafeteria environment and (3) National School Lunch Program participation.	Repeat cross-sectional (pre-post): Strong4Life School Nutrition Program 90-minute training session (2018)	Follow-up questionnaire with 842 participants (managers and staff).	Changes in participant knowledge, beliefs, and self-efficacy.	Significant improvements were noted in Ps for: <ul style="list-style-type: none"> <li>knowledge of improving taste perception by using appealing menu names (from 78% to 95%, <math>p &lt; 0.001</math>).</li> <li>understanding that food selection is influenced by location in the lunch line (from 78% to 95%, <math>p &lt; 0.001</math>)</li> <li>self-perceived capacity to modify the cafeteria environment (from 91% to 96%, <math>p &lt; 0.001</math>).</li> </ul> Participation in school lunch in the month following training did not change.	Funding: Strong4Life Program at Children's Healthcare of Atlanta. Authors were employed by Children's Healthcare of Atlanta's Strong4Life Program
Beckelman (2020) <sup>60</sup> CHN Low (-)	To describe the efforts of the Hawaii State Department of Health to scale up the CHN program through partnerships with two convenience store chains at a statewide level.	Cross-sectional (2015)	Adults > 18 years living in Hawaii ( $n = 162$ ); exit store survey and Hawaii Behavioral Risk Factor Surveillance System, a statewide random digit-dial telephone survey.	Awareness of CHN and influence: exit surveys with convenience store customers > 18 years	Store survey exit: convenience and price were the most influencing factors, followed by health and nutrition. Nearly half of Ps ( $n = 162$ ; 46.3%) recalled seeing a CHN sign in the store when shown an example. Sign recall did not differ by age, gender, and ethnicity. Among those who recalled seeing a sign ( $n = 75$ ), 13.3% said that it influenced their purchases. Telephone survey: one-third (34.8%) said having seen or heard a CHN campaign advertisement, especially native Hawaiian and other Pacific Islanders, who had a higher recall rate (43.6%)	None reported

HFP, healthy food partnership; Info, information; Na, sodium; NR, not reported; NZ, New Zealand; NZHF, New Zealand Heart Foundation; P, participants; PAHO, Pan-American Health Organization; Ref, reformulation; RTE, ready-to-eat; Sig, significant.

In Australia again, three studies assessed potential achievements or the policy process of the FHD using documents. Elliot *et al.* (2014)<sup>66</sup> (low quality) assessed whether the FHD was reducing premature death and disability but found that the data available were limited, with several reports on achievements missing, concluding that the current voluntary approach to preventing diet-related ill health is insufficient. Jones *et al.* (2016)<sup>67</sup> (low quality) evaluated the FHD over 6 years (from October 2019 to September 2013) but found limited data to assess achievements,<sup>67</sup> much like Elliot *et al.* (2014). They found that no information about milestones had been published since October 2011. They concluded that strong government leadership, adequate funding, clear targets and timelines, management of conflict of interest, comprehensive monitoring and evaluation, and a plan for responsive regulation in the event of missed milestones will be required to ensure that the new partnership set out as a continuity of the FHD, the Healthy Food Partnership, achieves its public health goals.<sup>66</sup> This echoes the studies on the Public Health RD (England, UK) below.<sup>56</sup> Lindberg *et al.* (2017)<sup>68</sup> (high quality) set out to understand whether salt reduction was a priority for processed food manufacturers in Australia. They reported that manufacturers did not appear to be making significant and comprehensive positive (nutrition) changes in relation to salt. This included 16 of the 33 manufacturers assessed not providing evidence of reducing salt in their products.

For New Zealand, Dunford *et al.* (2011) (low quality) reported an estimated 7% reduction of mean sodium content in bread products compared to none in Australia, highlighting important disparities between company efforts. The authors felt that this indicated lack of government leadership, non-governmental organisations (NGOs) lack authority and resources, and a renewed need for committed leadership from the government.<sup>54</sup>

Four studies evaluated the Public Health RD in England, UK. As part of the RD evaluation covering alcohol, food, physical activity and health at work, Knai *et al.* (2015)<sup>56</sup> (high quality) reported on the effectiveness of the food pledges using policy documents. Much like Elliot *et al.* (2014) and Jones *et al.* (2016) in Australia, they found that the lack of data reported by participating food industries made the evaluation challenging. They reported an overall lack of additionality of the RD, as most of the reported actions were already underway (meaning that the PPP had had little added value). They also found that the majority of the food pledges propose interventions that favour information provision, awareness raising and communication with consumers, which may have limited effect. Another study by Knai *et al.* (2017) (high quality) focused specifically on the RD's trans-fat reduction pledges. Based on progress reports from 2015, the pledges appeared to have had negligible impact on reducing artificial trans-fats from England's food supply beyond pre-2011 levels.<sup>13</sup> The authors concluded that the most effective strategies to improve diet are not reflected in the RD food pledges, and that there was paucity and heterogeneity of organisations' progress reports. Hutchinson *et al.* (2018)<sup>58</sup> (low quality) assessed whether the RD resulted in different intakes of trans-fatty acids (TFA) across different socioeconomic groups before (2000–11) and after the PPP (2010–2). They reported that voluntary reformulation had had some effect in reducing TFA of many UK products, when comparing data from the National Diet and Nutrition Surveys before and after the RD implementation. However, the surveys only include a small variety of popular foods and brands from large retailers, which may mask TFA differences between foods consumed by different population groups. High TFA consumption was associated with socio-economic disadvantage pre-RD, but post results were less clear regarding inequalities. Finally, Robinson *et al.* (2019)<sup>57</sup> (unclear quality) studied calorie labelling practices in the UK eating out of home sector in 2018 and whether they were aligned with the RD pledges. They found that it was rare for eating out and takeaway chains to provide in store kcal labelling and when labelling is provided it does not meet recommended labelling practices.

Four studies from the United States. Two of these, both by Ng *et al.* 2014<sup>51,59</sup> (moderate quality), evaluated the impact of the HWC on total calories sales and calories purchased. They both reported successes, including over 10% fall in calories sold over the 5-year pledge period among participating companies, though absolute caloric sales from retailers' private label products essentially did not change. As with the RD evaluation findings, the additionality of the HWC, that is whether there was

added value from signing up to it to motivate change (e.g. reformulation), was questioned, and was reported as potentially relating to factors beyond the pledges such as changes in consumer demands, or economic factors. Moreover, it should be noted that 13 of the 16 signatories also belong to the CFBAI, which is another self-regulated voluntary pledge by the industry. Two other American partnerships were evaluated: Rajbhandari-Thapa (2017)<sup>61</sup> (low quality) evaluated the Strong4Life School Nutrition Program. They found that the programme's training increased school nutrition manager and staff member knowledge of the Strong4Life Smart Serving Strategies, as well as their beliefs, self-efficacy, and confidence in their ability to make positive behavioural and environmental changes in the school cafeteria. Beckelman (2020)<sup>60</sup> (low quality) assessed the Hawaii State Department of Health's work to scale up the CHN programme through partnerships with two convenience store chains at a statewide level. The programme was considered a mutually beneficial partnership, with leadership buy-in, support for implementation, and a need to meet retailer needs, for example, modifying signage size and type.

The findings remain the same when looking at the types of participants or study quality with a majority of studies pointing towards inconclusive or no effects overall except for human studies. Studies of food products and labelling practices showed overall mixed or negative results independently of study quality. Similar observations can be made for the document analyses, which all pointed towards a lack of information, lack of commitments, and/or unlikelihood of the policy to provide added value independently of their quality. As for the five human studies, they showed mixed results overall. The three human studies that showed overall positive effects were of low quality, while the two of moderate quality showed mixed results. This might be due to the types of outcomes assessed: two of the positive studies reported on participants' awareness and self-efficacy rather than changes in the environment or human behaviours and another measured trans-fat intake, while studies with mixed results examined calorie sales and purchases. The type of products assessed could also explain the differences in directions of effects noted for the FHD, that is it is possible that progress was indeed made in soups and processed meats overall but not in other product categories.

## Conclusions

This systematic review aimed to complement the overview of reviews (see [Chapter 4](#)) by assessing the effectiveness of PPPs targeting the food environment since the overview of reviews did not include data on the latter. From the available evidence reviewed across 17 studies evaluating 7 PPPs, partnerships with the food industry to improve diets via reformulation or other changes to the environment appear to have limited effectiveness at achieving this aim.



# Chapter 6 Systematic review on the effectiveness of voluntary approaches by commercial actors to improve food environments and population diet

## Introduction

This systematic review aims to complement the overview of reviews (see [Chapter 4](#)), which provided limited information on voluntary approaches by private actors. It assesses the effectiveness of voluntary approaches by private actors aiming to improve food environments by measuring the differences between participating and NP organisations, including compliance to the policy guidelines and effects on the food environment, dietary intake and health.

## Methods

### *Literature search and eligibility criteria*

The systematic evidence map identified 183 primary studies that assessed the effectiveness of a voluntary policy (including the voluntary element of interventions, which include both a regulatory and voluntary component) (see [Chapter 3, Figure 8](#)). Studies of any design (including document analyses) were considered if they assessed effects on the food environment, human behaviour or health, or the economy; or if they assessed the content or progress of the policy itself. Results had to be provided for voluntary approaches separately, that is those aggregated with findings for other governance approaches were excluded. Three additional criteria specific to this review were also added and screened by a single reviewer (SR, LB): (1) Initiatives developed and implemented by a single company were excluded; (2) The study had to compare organisations participating in the policy to NPs in terms of adherence or compliance to policy guidelines or effects on the food environment, dietary intake or health; (3) Due to the high number of studies potentially eligible and the limited time available, we focused on research articles published in the past 4 years (2017–20). Annual reports on advertising control policies of the voluntary and private sectors were excluded. The references of the included studies were screened against the above eligibility criteria.

### *Data extraction*

In addition to the policy and evaluation characteristics extracted for the systematic evidence map (see [Chapter 3](#)), we documented in a standardised extraction form the following information: policy and study objectives, the policy leader, implementation and data collection dates, study design, samples' characteristics, results about effects or adherence between participants and NPs including effect size and precision estimates, and potential competing interests of study authors using information from the declaration of competing interests, funding sources and authors' affiliations. For studies on advertising control policies, we only extracted outcomes relating to unhealthy foods because these are the ones that such policies normally aim to control for; and when on TV we captured such outcomes during both children's peak time and children's programmes (CP) since children are normally the target population of these policies. Data were extracted by one reviewer (SR, GB, JB, LB) and checked by another (GB, JB, LB).

### Quality appraisal

Study quality was assessed using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies (see [Chapter 2](#)). Studies were rated on seven domains and rated overall as having a low, moderate, high or unclear quality. Each item was assessed by one reviewer and checked by another two. Modifications to the tool are explained in [Chapter 2](#) and detailed in [Appendix 4, Table 26](#). For appraising ascertainment to exposure when participation status in a policy was unclear, we compared the number of participants described in the policy characteristics data extraction form to those mentioned in the study to get a sense of whether participation status was up to date in the study and was likely to have remained relatively stable.

### Data synthesis

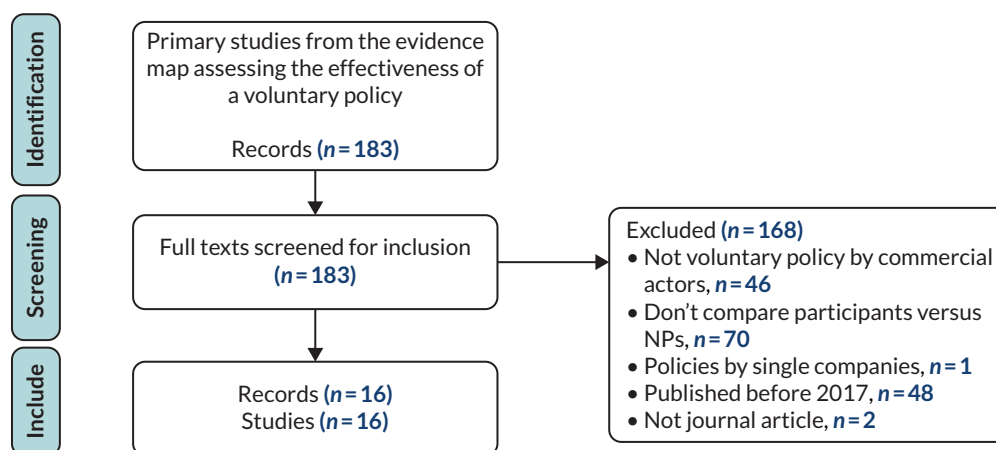
Due to the high heterogeneity in the outcomes assessed, data were synthesised narratively by policy and type of outcome by considering the direction of effect between participants and NPs. For a graphical representation of the summary findings, we used an effect direction plot<sup>26,27</sup> (see [Chapter 2](#)), displaying non-standardised effects across multiple outcome domains. Studies were grouped by policy and ordered by overall study quality, publication date and study design. The effect direction plot was also used to present jointly the direction of effect, study quality and indirectness, which was a compromise for not using the GRADE framework (see [Chapter 2](#)).

## Findings

Of the 183 primary studies in the evidence map assessing the effectiveness of a voluntary policy, 16 met the inclusion criteria after full-text screening. The remainder ( $n = 167$ ) were excluded as they did not include commercial actors or focused on a single company ( $n = 47$ ), did not compare participants versus NPs ( $n = 70$ ), did not meet the publication date cut off ( $n = 48$ ) or were not journal articles ( $n = 2$ ). The selection process is illustrated in [Figure 13](#). The excluded studies along with the justifications are listed in the [Report Supplementary Material 1](#).

### Commitment characteristics

Nine policies, implemented across seven countries [Australia, Belgium, Canada, Germany, the Netherlands, UK (England), USA], were evaluated. [Table 13](#) presents the characteristics of the policies across the time period that they were evaluated. Four policies were in Australia, namely the FHD ( $n = 2$ ),<sup>63,65</sup> the Healthier Australia Commitment ( $n = 1$ ),<sup>70</sup> the QSRI ( $n = 3$ ),<sup>71–73</sup> two of which also included the Responsible Children’s Marketing Initiative (RCMI) ( $n = 2$ ).<sup>71,72</sup> The remaining five consisted of the CFBAI in Canada ( $n = 5$ ),<sup>74–77</sup> the European (EU) Pledge evaluated in Belgium, the Netherlands and Germany ( $n = 2$ ),<sup>78,79</sup> the Public Health RD in England, UK ( $n = 1$ ),<sup>57</sup> and both the CFBAI ( $n = 2$ )<sup>80,81</sup> and



**FIGURE 13** PRISMA flow chart representing the selection process for the review of voluntary approaches. Adapted from the PRISMA template by Page *et al.* (2021).<sup>16</sup>

**TABLE 13** Quality appraisal in the studies (n = 16)

Study	Selection				Comparability	Outcome		Overall rating
	Representativeness	Sample size	Missing data	Ascertainment of the exposure (policy)	Confounding	Outcome assessment	Statistical test	
Harris (2018) (study 1) <sup>80</sup>	Moderate (+)	Unclear	Unclear	High (++)	Moderate (+)	High (++)	Unclear	Unclear (?)
Landwehr (2020) <sup>79</sup>	Moderate (+)	Moderate (+)	Unclear	High (++)	Moderate (+)	Moderate (+)	High (++)	Moderate (+)
Levi (2018) <sup>63</sup>	Moderate (+)	High (++)	Unclear	Unclear	Moderate (+)	High (++)	High (++)	Unclear (?)
Moran (2017) <sup>82</sup>	Moderate (+)	Unclear	High (++)	Low (-)	Moderate (+)	High (++)	High (++)	Low (-)
Neyens (2017) <sup>78</sup>	Low (-)	Moderate (+)	Unclear	Unclear	Moderate (+)	Moderate (+)	Unclear	Low (-)
Potvin Kent (2018) Online <sup>76</sup>	Moderate (+)	High (++)	Unclear	High (++)	Moderate (+)	Moderate (+)	High (++)	Moderate (+)
Potvin Kent (2018) TV <sup>74</sup>	Moderate (+)	Moderate (+)	High (++)	High (++)	Moderate (+)	Low (-)	High (++)	Low (-)
Potvin Kent (2020) <sup>75</sup>	Moderate (+)	Moderate (+)	Unclear	High (++)	Moderate (+)	Moderate (+)	High (++)	Moderate (+)
Robinson (2019) <sup>57</sup>	Moderate (+)	Unclear	Unclear	High (++)	Moderate (+)	Moderate (+)	Unclear	Unclear (?)
Smithers (2019) <sup>71</sup>	Low (-)	Unclear	Unclear	High (++)	Moderate (+)	Moderate (+)	Unclear	Low (-)
Sparks <i>et al.</i> (2018) <sup>65</sup>	Moderate (+)	Unclear (?)	Unclear (?)	N/A (P and NP combined)	Low (-) (P and NP combined)	Low (-)	High (++)	Low (-)
Spiteri (2018) <sup>70</sup>	High (++)	Unclear	High (++)	Unclear	Moderate (+)	High (++)	High (++)	Unclear (?)
Vaala (2020) <sup>81</sup>	Low (-)	Moderate (+)	Unclear	High (++)	Moderate (+)	Moderate (+)	High (++)	Low (-)
Vergeer (2019) <sup>77</sup>	Moderate (+)	High (++)	Unclear	High (++)	Moderate (+)	Moderate (+)	High (++)	Moderate (+)
Watson (2017) <sup>72</sup>	Moderate (+)	High (++)	High (++)	High (++)	Moderate (+)	Moderate (+)	High (++)	Moderate (+)
Wellard-Cole (2019) <sup>73</sup>	High (++)	Unclear	High (++)	High (++)	Moderate (+)	Low (-)	High (++)	Low (-)

Kids LiveWell ( $n = 1$ )<sup>82</sup> in the USA. Seven of these policies [Canadian Children's Food and Beverage Advertising Initiative (CAI), CFBAI, EU Pledge, Healthier Australia Commitment, Kids Livewell, QSRI and the RCMI] were officially led by a private organisation representing food and beverages corporations while the remaining two (RD and FHD) were led by a governmental institution. The Australian FHD, the Healthier Australia Commitment, and the RD in England were PPPs. The number of participating commercial actors across the policies ranged from 7 (QSRI) to 150 (Kids LiveWell<sup>82</sup>).

Regarding the policy categories assessed using the NOURISHING framework, unsurprisingly, the five advertising control policies (CAI, CFBAI, EU Pledge, RCMI, QSRI) were evaluated from an R-Advertising and marketing perspective; the QSRI was also assessed in the S-Retail and food service sector (children's meals in fast-food outlets). The effect of both Australian partnerships was assessed on product reformulation (I) while studies of Kids LiveWell and the RD focused on labelling.

The five policies that include an advertising and marketing control component implied not to advertise unhealthy food to children under a certain age, which varied between 6 years old with the CFBAI in the USA to 12 years old with the CAI in Canada and the EU Pledge (although as part of the EU pledge, the Netherlands committed to prohibit it to < 7-year-olds only). The nutritional criteria used to define healthy or unhealthy food varied across the policies. The FHD was launched with specific sodium targets for healthier products. Healthier Australia Commitment provided a relative percentage decrease in sodium, saturated fat and energy. Four policies (CAI, CFBAI, EU Pledge and QSRI) were launched without unified criteria but implemented criteria later on (CFBAI in 2013, QSRI and EU Pledge in 2014 and CAI in 2018). Signatories to the RCMI developed their own nutritional criteria and the definitions were reported as being unclear (9). Nutritional criteria were also unclear or vague for Kids LiveWell and the RD.

### **Study characteristics**

All studies were cross-sectional: nine measured data at a single point in time (single cross-sectional) and seven at two points in time after the policy was implemented (repeat pre-post). None used humans as participants but rather analysed food items, adverts and other environmental features. All policies were assessed at least 3 years after their introduction, which should have given some time for participants to implement changes, and 12 studies evaluated effects after at least 7 years after implementation (especially for advertising and marketing outcomes). Sample size of participant groups ranged from seven companies [sample size can be especially small when studies compare number of companies participating (P) and NP, which are limited] to about 100–200 participating products or adverts. One study assessed over 35 million food adverts on websites from participating companies.

### **Study quality appraisal**

The overall judgement of each domain and final rating for each study is noted in [Table 13](#). Studies about advertising and marketing control were generally of higher quality than those on the retail and catering sectors. Overall, six studies were assessed as having a low quality overall, five as moderate, and four were judged 'unclear'. None were rated as high. Across all studies, there were concerns identified about selection bias with three studies using convenient or non-representative samples. There were generally low concerns about the ascertainment of the exposure except for one study mentioning that participation status in a policy had changed through time and was not accounted for in the analysis; otherwise, there were no obvious reason to believe that authors did not use an up-to-date list of participants or that participant status changed during the evaluation period and was not accounted for bias arising from comparability of participants and confounding factors controlled, although in some studies information was unclear. In outcome assessment, two studies had their data collected by a single researcher only. Only five studies included appropriate information on how they dealt with missing information and nine justified their sample size. When reported, the use of statistical tests was judged appropriate, but four studies failed to report information on their statistical analysis.

No important conflicts of interest were identified for authors of any of the 16 studies included ([Table 14](#)). Two studies' lead author had previously worked on research projects funded by the food

TABLE 14 Characteristics of the voluntary approaches (n = 9)<sup>a</sup>

Voluntary approaches (associated studies)	Country; lead org	Policy categories assessed	I and Eval years	N participants between I and last E years	Commitment objectives	Criteria for defining healthy and unhealthy food
CFBAI <sup>74-76</sup>	CAN; Ad Standards	R-Ad&Mkt	I: 2007; E: 2013-7	16 companies in 2007; 18 from 2009 to 2016	To promote healthy diets and lifestyles in all child-directed marketing activities. Seven companies pledged to only advertise 'healthier dietary choice' products to children < 12 years. 11 pledged not to direct any advertising to children < 12 years in various media. <sup>75</sup>	Uniform Nutrition Criteria implemented in 2015. Specify nutrition criteria for eight product categories: milk and alternatives, grains, soups, meat and alternatives, vegetables and fruit, occasional snacks, mixed dishes, and meals on the go. None for chocolate, candy, and soft drinks because they should not be advertised to < 12 seconds. Nutrients to limit: calories, saturated and trans fats, sodium, and total sugars. Nutrients to encourage: vitamin D, calcium, potassium and fibre. <sup>76</sup>
CFBAI <sup>80,81</sup>	USA; BBB National Programs	R-Ad&Mkt	I: 2006; E: 2013-8	10 companies in 2006; 13 in 2008; 18 from 2012 to 2018	Originally: to promote self-regulation to improve the healthfulness of foods marketed across media platforms to children < 12 years. From 2010: to not use licensed characters, celebrities, and athletes in any advertising for unhealthy foods. <sup>83</sup> From 2016 or before: 17 out of 18 companies pledged to not direct any marketing to children < 6 years. <sup>80</sup>	Uniform criteria adopted in December 2013 and updated in 2018. Specify criteria for both healthy and unhealthy food. Breakfast cereals: to be advertised, cereals must contain the following per serving (portion size NR): < 200 cal, < 1.5 g of saturated fat, < 290 mg of sodium and ≤ 12 g added sugar. <sup>81</sup>
EU Pledge <sup>78,79</sup>	EU (studies in BEL, GER and NET); World Federation of Advertisers	R-Ad&Mkt	I: 2007; E: 2012-4	11 in 2007; 19 in 2012; 20 in 2013; 21 in 2014	To restrain from unhealthy food advertising to audiences including at least 35% children < 12 years old on television, internet as well as promotional activities in schools (the Netherlands pledged to prohibit it to < 7-year-olds only). From 2014: only advertise products to children < 12 that meet the common EU Pledge Nutrition Criteria; or to not advertise products at all to children under the age of 12 years; products not in compliance with pre-defined nutritional criteria not to be advertised in television programmes with at least a 35% child audience.	Initially companies defined their own. In 2014, the EU Pledge Nutrition Criteria was adopted (10 food categories).

continued

TABLE 14 Characteristics of the voluntary approaches (n = 9)<sup>a</sup> (continued)

Voluntary approaches (associated studies)	Country; lead org	Policy categories assessed	I and Eval years	N participants between I and last E years	Commitment objectives	Criteria for defining healthy and unhealthy food
FHD <sup>63</sup>	AUS; Federal Government	I-Ref	I: 2009; E: 2010–7	NR (~90% of soups retailed in Australia were produced by participants when sodium targets were set); 2510 processed meat products, including bacon and sausage	To act on food innovation through a voluntary reformulation programme on packaged foods, consumer education and portion standardisation in order to reduce the saturated fat, added sugar, sodium and energy content, and increase the fruit, vegetable, fibre and wholegrain content of foods in order to make 'healthier' food choices more accessible to Australians. <sup>63</sup>	Sodium targets (mg/100 g) for the participants: <ul style="list-style-type: none"> <li>• Dry soups: max 290</li> <li>• Wet soups: max 300</li> <li>• Bacon, ham and cured meat products: max 1090</li> </ul> <ul style="list-style-type: none"> <li>• Emulsified luncheon meats (processed deli meats): max 830</li> <li>• Wet savoury pasties: max 400</li> <li>• Dry savoury pasties: max 500</li> </ul>
Healthier Australia Commitment <sup>70</sup>	AUS; Australian Food and Grocery Council	I-Ref	I: 2012; E: 2015	Eight major companies in 2012; unclear in 2015	To reduce sodium by 25%, saturated fat by 25%, and energy by 12.5% by 2015.	Target based on % reduction
Kids LiveWell <sup>82</sup>	USA; National Restaurant Association	N-Menu label	I: 2011; E: 2012–5	Membership growing since 2011; 150 restaurants across 42,000 locations in 2015	To increase the number of nutritious menu items available to children (only requires offering one children's meal and one other item that meet the nutrition standards).	Unclear and website does not exist anymore
QSR <sup>71–73</sup>	AUS; Australian Food and Grocery Council	R-Ad&Mkt S-R&S	I: 2009; E: 2015–7	Seven fast-food outlets between 2009 and 2017	To reduce the advertising of discretionary foods to children; to help promote healthy dietary choices and healthy lifestyles amongst children.	2014 Nutrition Criteria specifying maximum energy, saturated fat, sugar and sodium content for meals as well as (vague) criteria for meal composition

Voluntary approaches (associated studies)	Country; lead org	Policy categories assessed	I and Eval years	N participants between I and last E years	Commitment objectives	Criteria for defining healthy and unhealthy food
RCMI <sup>71,72</sup>	AUS; Australian Food and Grocery Council	R-Ad&Mkt	I: 2009; E: 2015–7	15 food and grocery manufacturers in 2009; 17 between 2010 and 2016; 18 in 2017	To reduce advertising and marketing communications to children of food and beverage products that do not represent healthy choices; to help promote healthy dietary choices and healthy lifestyles amongst children.	Companies established their own nutrition criteria to determine foods appropriate for marketing to children. 'Unclear definitions of what constitutes unhealthy food'
The Public Health RD <sup>57</sup>	England, UK; Department of Health (England)	N-Menu label	I: 2011; E: 2018	16 large food service chains had signed the kcal labelling pledge as of 2018	The focus on labelling included to display calorie information at the point of choice (i.e. menus, shelves), which included seven specific recommendations.	N/A for the kcal labelling pledge

BBB, better business bureaus; Eval, evaluation; I, implementation; I-Ref, I-Reformulation by manufacturers; NR, not reported; R-Ad&Mkt, R-Advertising and marketing; S-R&S, S-Retail and food service sector.  
a At the time of their implementation and evaluations.

industry (American Beverage Association, Unilever, Nestlé, and the Dairy farmers of Canada). In 10 studies, authors declared having no conflict of interest; the remaining did not have a competing interest declaration. Funding was received from government or research bodies, universities, and private or not-for-profit organisations. Six studies did not report their source of funding. Authors were affiliated with universities or other public organisations (with affiliations partly unclear in three studies).

### **Effects of voluntary approaches**

**Table 15** presents the study characteristics and key findings.

The CFBAI in Canada was the most assessed policy, with four studies (three moderate and one low quality) concluding that there were mixed effects for the advertising of unhealthy foods to children on television,<sup>74</sup> that participants used more child-directed marketing strategies to promote unhealthy foods on websites than NPs,<sup>77</sup> that food advertised on websites to children were in majority unhealthy,<sup>76,77</sup> and that participants did not conduct fewer corporate social activities to promote their brands to children.<sup>75</sup>

The CFBAI in the USA was evaluated twice (moderate and unclear quality) and shown overall as having worse effects among participants than NPs. Participants advertised unhealthy foods during children's television programmes more frequently,<sup>80</sup> used more marketing practices on breakfast cereal packages, and the cereals said to meet CFBAI's nutrition criteria had smaller serving sizes and lower density, suggesting that their nutritive values do not represent quantities likely to be eaten.<sup>81</sup>

The EU Pledge had mixed effects in two studies (moderate and low quality) for a range of outcomes relating to advertising of unhealthy foods to children both on television and online including the number of adverts, nutrition profiles, use of marketing tactics and children's protection strategies online.<sup>78,79</sup>

The FHD in Australia was the only policy to show some better overall outcomes for participants, albeit with limitations including imprecise data.<sup>65</sup> The study by Levi *et al.*<sup>63</sup> (unclear quality) was a post-post cross-sectional study evaluating whether soup products, classified as dry and wet (canned and chilled) met the policy's sodium targets. Sodium content was collected in 2011, 2012, 2013 and 2014 using food databases and labels. In 2014, 1153 soups were assessed, of which 68 were dry from participants (compared with 20 NPs); and 125 were wet from participants (compared with 87 NPs). Figures (no data provided) show a greater proportion of participating soups below the target for both categories compared to NPs. Mean sodium content in dry participating soups reduced significantly since 2011 but not for wet soups nor either NP soup categories, although this might be partly due to small sample sizes limiting statistical power. No values on sodium content and number of products meeting targets were provided. The study was rated as having unclear study quality due to a lack of reporting on missing data and ascertainment of participant status. Sparks *et al.* (2018)<sup>65</sup> (low quality) assessed sodium levels in processed meats between 2010 and 2017. They reported an 11% reduction in median sodium levels in the processed meats that had salt targets versus no change in those without targets. However, by category of products they reported mixed results with significant reductions in bacon, ham/cured meat and wet savoury pasties ( $p < 0.001$ ,  $p = 0.012$  and  $p = 0.006$ , respectively) and no change in emulsified luncheon meats ( $p = 0.363$ ) and dry savoury pasties ( $p = 0.111$ ).

A study by Spiteri *et al.*<sup>70</sup> (unclear quality) on the Healthier Australia Commitment assessed 'healthfulness' of all new food and beverages launched in the country in 2015 using three nutrition profiling systems. Participants had launched greater proportion of foods classified as unhealthy according to the three systems (all  $p < 0.001$ ).

Regarding the Kids LiveWell in the USA, Moran *et al.*<sup>82</sup> (low quality) compared trends in calories, sodium and saturated fat content of children's menus (entrees, side dishes, desserts and beverages) in participating and NP large chain restaurants. Results were inconclusive for all three indicators.



TABLE 15 Study characteristics and results (n = 16)

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
<b>N-Calorie menu labelling (n = 2)</b>							
Robinson <i>et al.</i> (2019) <sup>57</sup>	RD (England, UK)	To examine the proportion of major catering chains that provide calorie information at point of sale, and if current practices comply with the RD recommendations	Cross-sectional (post, once) August 2018	Food and beverage items (N NR) from 104 large chains including cafés, coffee shops, takeaways, fast-food and full-service restaurants [P: 16 (15%) restaurants chains; NP: 88]	<ul style="list-style-type: none"> <li>• Presence of calorie labelling</li> <li>• Adherence to policy guidelines.</li> </ul> Verified by contacting companies, reviewing websites and conducting some physical audits. Focus on children: N	<ul style="list-style-type: none"> <li>• Of the 104 chains, 18 displayed calorie labelling in stores: 12 (67%) of RD pledge P (67% of all P) and 6 (7%) of NPs.</li> <li>• None fulfilled all seven recommended labelling criteria. Only one P and two NP chains provided calorie labelling for all items sold.</li> </ul>	<ul style="list-style-type: none"> <li>• Lead author has worked on research projects funded by American Beverage Association and Unilever.</li> <li>• Funding: Medical Research Council.</li> <li>• Affiliations: university and NR.</li> </ul>
Moran (2017) (20)	Kids LiveWell (USA)	To identify trends in nutrient content of beverages, entrées, side dishes, and desserts offered on children's menus following the implementation of the Kids LiveWell initiative	Repeat cross-sectional (post-post) January 2012, 2013, 2014 and 2015	4016 children's menu items from 45 of the top 100 fast-food, fast-casual, and full-service restaurants [P: 890 (47%) beverages, 639 (46%) entrées, 321 (82%) side dishes and 152 (84%) desserts from 15 restaurants; NP: 996 beverages, 739 entrées, 2010 side dishes and 69 desserts from 30 restaurants]	Changes in calories (kcal), sodium (mg), and saturated fat (g) content between 2012 and 2015* of: <ul style="list-style-type: none"> <li>• Beverages</li> <li>• Entrees</li> <li>• Side dishes</li> <li>• Desserts.</li> </ul>	Between 2012 and 2015: <ul style="list-style-type: none"> <li>• The average calorie content in children's menus increased by 49 (95% CI = 4.6 to 92.7) in side dishes in P compared with NP restaurants. It also increased by 14 (0.3 to 27.1) in beverages in P, but the difference with NP was not statistically significant [14 (-1.0 to 29.6)].</li> </ul>	<ul style="list-style-type: none"> <li>• Funding NR</li> <li>• Declaration of Col NR</li> <li>• Affiliations: universities.</li> </ul>

continued

TABLE 15 Study characteristics and results (n = 16) (continued)

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
					Verified using the Menustat database and restaurants' websites Focus on children: Y	<ul style="list-style-type: none"> <li>Other non-stat significant changes between P and NP include calorie content in entrées [-19 (-50.6 to 11.8)] and desserts [9 (-41.6 to 59.2)]; sodium content (mg) in entrées [-21 (-106.2 to 64.6)], side dishes [0.9 (-0.1 mg (-0.1 to 1.9)] and desserts [0 (-34.7 to 34.2)]; and saturated fat content (g) in entrées [0.4 (-0.5 to 1.4)], side dishes [0.9 (-0.1 to 1.9)] and desserts [0.5 (-2.3 to 3.3)].</li> </ul>	
<b>R-Advertising and Marketing control: Television (n = 5)</b>							
Harris (2018) <sup>80</sup> (Study 1 only)	CFBAI (USA)	To assess the effectiveness of CFBAI pledges to not advertise to children under 6 years old	Cross-sectional (post, once) January–December 2015	Food, beverage and restaurant adverts for 59 brands (total N adverts NR) aired during children's programming on English-language networks, cable, and syndicated TV in the USA, [P: 28 brands from 9 (28%) companies, 28 brands; NP: 23 companies, 31 brands]	Differences in the volume of food and beverage advertising to children aged 2–5 and 6–11 on and outside CP. Using Nielsen Media Research data. Focus on children: Y	<p>During the whole year, pre-schoolers (2–5 years) saw an average of 732.2 food adverts (63% during children's TV) by P, including 134.2 by fast-food restaurants (12% during children's TV) vs. an average of 422.3 (37% during children's TV) by NP, including 78.3 by fast-food restaurants (7% during children's TV). Older children (6–11 years) saw an average of 910.0 food adverts (69% during children's TV) by P, including 157.2 by fast-food restaurants (12% during children's TV) vs. an average of 402.8 (31% during children's TV) by NP, including 84.7 (6% during children's TV).</p> <p>Less than 1% of adverts promoted products not approved for P companies for 6- to 11-year-olds. McDonalds was the only fast-food restaurant advertising on children's programming (and the only one that did not pledge to not advertise to under 6 seconds).</p>	<p>No apparent Col:</p> <ul style="list-style-type: none"> <li>Affiliations: university</li> <li>Funding: Robert Wood Johnson Foundation</li> <li>Declared having no Col.</li> </ul>

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
Landwehr (2020) <sup>79</sup>	EU Pledge (Germany)	To test the compliance and overall effectiveness of the EU Pledge in protecting children from HFSS advertising using the UK OFCOM nutrient profile	Repeat cross-sectional (post-post) October 2011 and October 2014	15,174 adverts recorded from 10 German TV networks (2 children's networks, 2 general public and 6 commercial television broadcasters) on one weekday and one weekend day (07.00–22.00) representing 596 hours of TV and 88 hours of advertisingNP [P: 239 (59%) adverts in 2011, 295 (71%) in 2014; NP: 163 adverts in 2011, 123 in 2014; N companies by participation status NR]	<ul style="list-style-type: none"> <li>Share and number of child-directed adverts on children and other programmes</li> <li>Adverts characteristics</li> <li>Nutritional quality of food and beverages shown.</li> </ul> Nutrient data from product packaging and company websites; classified using the EU Pledge criteria and UK OFCOM nutrient profile. Focus on children: Y	<p>The share of child-targeted food and beverage adverts networks decreased significantly for both P companies in total commercial (from 3.2% to 2.2%) and NP (from 2.2% to 1.6%) (<math>p &lt; 0.001</math>) and in children's networks (from 6.3% to 3.3% in P, and from 3.9% to 3.0% in NP) (<math>p &lt; 0.001</math>).</p> <p>The reduction of broadcasted spots in commercial and children's networks as well as the reduction of number of advertised products and average commercial lengths were not significant for both P and NP. The two groups were not compared together. By 2014, P companies had moved all child-targeted adverts for sweets outside CP (from 25 in 2011 to 0 in 2014) while those for fast-food brands increased in CP from 32 to 51 (<math>p &lt; 0.001</math>). By contrast, in 2014 advertised sweets in CP 107 times.</p> <p>A greater proportion of children-targeted food and beverages adverts in CP by P met the EU Pledge nutrition criteria between 2011 and 2014 (2011: 59.5%; 2014: 89.2%; <math>p &lt; 0.001</math>) compared to NP both before (<math>p = 0.013</math>) and after when these criteria were harmonised in 2014 (<math>p &lt; 0.001</math>). However, while a lesser share of NP adverts complied with the UK OFCOM nutrition profile in 2011 (<math>p = 0.007</math>), the difference became not significant in 2014.</p>	<ul style="list-style-type: none"> <li>Affiliations: universities</li> <li>Funding NR</li> <li>Declared having no Col.</li> </ul>

continued

TABLE 15 Study characteristics and results ( $n = 16$ ) (continued)

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
Potvin Kent (2018) <sup>74</sup>	CAI (Canada)	To assess whether the Uniform Nutrition Criteria used by CAI had an impact on the healthfulness of food and beverage advertising during children's television programming	Repeat cross-sectional (post-post) May 2013 and May 2016	242 adverts (2013) and 334 (2016) recorded from the first 30 min of programmes included in a 10% random sample of children's programming ( $\geq 35\%$ child audience) on 27 TV stations in Toronto. [P: 120 (50%) adverts in 2013, 187 (56%) in 2016; NP: 122 adverts in 2013, 147 in 2016N companies by participation status NR]	Proportion of adverts showing: <ul style="list-style-type: none"> <li>less healthy products according to the UK OFCOM nutrient profile</li> <li>Products excessive in total, saturated and trans-fats, and free sugars, sodium according to PAHO criteria.</li> </ul> Nutrient data from the FLIP for 2013 as well as company websites, product packaging in stores or the Canadian Nutrient File for missing 2013 data and the 2016 products. Focus on children: Y	<p>Between 2013 and 2016, using the UK nutrient profile, the frequency of adverts showing less healthy foods and beverages by <math>p</math> significantly reduced from 93.3% to 78.5% (<math>p = 0.000</math>) while the proportion did not change for NP (about 80%).</p> <p>Using the more stringent PAHO criteria, P significantly increased the proportion of advertised products excessive in trans-fat (from 10.0% to 24.2%, <math>p = 0.002</math>), and excessive in sodium (from 44.2% to 58.6%, <math>p = 0.014</math>), while the proportions for excessive total fat, saturated fat and free sugar remained similar. Among NP, there was a significant increase in the proportion of advertised products excessive in total fat (from 48.8% to 69.3%, <math>p &lt; 0.05</math>) and a significant reduction for excessive free sugars (from 66.9% to 47.9%, <math>p &lt; 0.05</math>), as well as non-significant increases for excessive trans-fat (29.8% to 35.7%) and sodium (48.8% to 60.7%).</p> <p>In both time periods, 99–100% of both P and NP advertisements featured products that were classified as excessive in at least one nutrient according to the PAHO criteria.</p>	<p>No apparent Col:</p> <ul style="list-style-type: none"> <li>Affiliation: universities</li> <li>Funding: Health Canada</li> <li>Declared having no Col.</li> </ul>

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates		Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
				Sample (N P; N NP)			
Smithers (2019) <sup>71</sup>	Not stated but likely both the RCMI and QSRI (Australia)	To describe advertising of discretionary foods on television during children's viewing times.	Cross-sectional (post, once). Between January and December 2017	25,980 food adverts recorded from four TV channels in Adelaide over 84 weekdays (24 hours per day). (N by participation status NR for both companies and adverts)	Frequency of discretionary (i.e. 'unhealthy') foods advertised per hour during children's peak time and programmes. Food was classified using the Australian Guide to Healthy Eating. Focus on children: Y	There was no statistical difference for the number of adverts per hour showing discretionary food between P and NP during: <ul style="list-style-type: none"> <li>children's peak time: 0.7 (0.7–0.8) for both P and NP</li> <li>CP: P: 0.9 (0.8–1.0); NP: 0.8 (0.8–0.8).</li> </ul>	<ul style="list-style-type: none"> <li>Affiliations: university-related;</li> <li>Funding NR;</li> <li>Declared having no Col.</li> </ul>
Watson (2017) <sup>72</sup>	RCMI and QSRI (Australia)	To investigate the impact of the self-regulatory initiatives on the rate of unhealthy food advertising to children 4 years after the last independent monitoring study of television food advertising in Sydney, Australia.	Cross-sectional (post, once) May 2015	973 food adverts recorded from 3 TV channels and 1 youth-oriented digital channel in Sydney, from 06.00 to 21.00 over 2 week days (16 hours in total) and 2 weekend days (22 hours in total). (N by participation status NR for both companies and adverts)	Proportion of adverts promoting 'non-core' (unhealthy) food. Nutritional information from food labels and company websites; classified using the Australian Dietary Guidelines. Focus on children: Y	<ul style="list-style-type: none"> <li>RCMI: There was no stat sign difference in hourly advertising rates of unhealthy 'non-core' food between P and NP (0.81 vs. 0.67; <math>p \leq 0.5</math>).</li> <li>QSRI: 83% of 'non-core' fast-food adverts were by P. P significantly (<math>p &lt; 0.05</math>) showed on average more adverts per hour of non-core fast-food adverts (1.9) than NP (0.23).</li> </ul>	<ul style="list-style-type: none"> <li>Affiliations: university and Cancer Council New South Wales</li> <li>Funding NR</li> <li>Declaration of Col NR.</li> </ul>

continued

TABLE 15 Study characteristics and results (n = 16) (continued)

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
<b>R-Advertising and Marketing control: websites and mobile applications (n = 4)</b>							
Neyens (2017) <sup>78</sup>	EU Pledge (Belgium and the Netherlands)	To examine to what extent signatories' websites abide by their own self-regulation, and to evaluate the nutritional quality of advertised food and beverages they market to children.	Cross-sectional (post, once) Date NR, likely 2014	440 products on 49 child-targeting websites [P: 15 (31%) websites; NP: 34]	<ul style="list-style-type: none"> <li>• Presence of online marketing tactics including online protection</li> <li>• Nutrient profile (score) of advertised products. The higher the points, the less healthy.</li> </ul> Nutrition information from unclear source; classified using the UK OFCOM nutrient profile. Focus on children: Y	Only four websites, all from P, used age blocks to restrain children under 12 forbid children younger than 12 to enter the websites. None used ad-break warnings raise children's awareness of adverts. P (mean rank = 25.43) did not display more parental information than NP (mean rank = 24.81) ( $U = 261.5$ , $z = 0.15$ , $p = 0.885$ , $r = 0.003$ ). There were few differences between P and NP with regards to the use of marketing. While NP websites promoted more the benefits of their brand sig (mean rank = 28.26) than P websites (mean rank = 17.60) ( $U = 144$ , $z = -2.41$ , $p = 0.016$ , $r = 0.34$ ), spokes-characters were more present on P websites ( $U = 359$ , $z = 2.39$ , $p < 0.017$ , $r = 0.34$ , mean rank = 31.93) compared with NP websites (mean rank = 21.94). The average nutrition score did not differ significantly between food brands from P (mean rank = 16.36) and NP (mean rank = 15) ( $U = 114$ , $z = 0.41$ , $p = 0.703$ , $r = 0.075$ ..	<ul style="list-style-type: none"> <li>• Affiliations: university</li> <li>• Funding NR</li> <li>• Declared no having Col.</li> </ul>

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
Potvin Kent (2018) <sup>76</sup>	CAI (Canada)	To examine the frequency and healthfulness of food advertising on children's preferred websites and to compare the frequency and nutritional quality of these food adverts between companies participating in the CAI and those not participating.	Cross-sectional (post, once) Between June 2015 and May 2016	~54 million food and beverage adverts from the most popular ten websites (n = 37) for children aged 2-11 years in Canada. [P: ~35.5 million (79%) adverts; NP: ~18.5 million]	<ul style="list-style-type: none"> <li>Proportion of adverts showing processed food</li> <li>Nutrient content per 100 g (energy, carbohydrates, sugar, sodium as well as total, saturated and trans fats) of products.</li> </ul> Nutrition data from the company websites, labels or Canadian Nutrient File, classified using the PAHO and UK OFCOM nutrient profiles. Focus on children: Y	92.7% of adverts were for ultra-processed foods. Those on P websites were 2.5 times more likely to be ultra-processed (vs. unprocessed or processed) compared with NP (94.9% vs. 88.2%; $p < 0.001$ , OR = 2.5, 95% CI 2.5 to 2.5; data not shown). In terms of average nutrient content per 100 g, compared to NP, P products were significantly higher in energy [mean difference (MD) 141 kcal], carbohydrates (MD = 39.2 g), sugar (MD = 18.2 g) and sodium (MD = 70.0 g) (all $ps \leq 0.001$ ). They also contained more total fat and fibre, and less proteins, saturated fat and trans-fat (although the difference for the latter was negligible) (all 95% CIs excluded 1). Using the UK nutrient profile, 78.4% of P adverts were for less healthy products compared to 59% of NP. Using the PAHO system, P products were significantly less likely to be excessive in total fat (10.7% vs. 52.7%, $p \leq 0.001$ ), saturated fat (16.8% vs. 45.5%, $p \leq 0.001$ ), trans-fat (4.1% vs. 7.1%, $p \leq 0.001$ ) and sodium (39.7% vs. 56.2%, $p \leq 0.001$ ) than NP, but P products were more likely to have an excess of free sugars (89.0% vs. 40.5%, $p \leq 0.001$ ) than NP.	No apparent Col: <ul style="list-style-type: none"> <li>Affiliation: university</li> <li>Funding: Heart and Stroke Foundation and Toronto Public Health</li> <li>Declared having no Col.</li> </ul>

continued

TABLE 15 Study characteristics and results ( $n = 16$ ) (continued)

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
Potvin Kent (2020) <sup>75</sup>	CAI (Canada)	To determine if CAI signatories participate in fewer child-related Corporate Social Responsibility (CSR) activities (nutrition and physical activity) than non-signatories.	Cross-sectional (post, once). Between June and August 2016	63 CSR identified on the webpages, Facebook pages and corporate reports of 39 companies. [P: 36 (57%) CSR activities from 18 companies; NP: 27 (43%) CSR activities from 21 companies]	Nature and targeted demographic of physical activity and nutrition-related CSR initiatives. Focus on children: Y	P had a higher proportion of nutrition-related initiatives (72%) and a lower proportion of child-targeted initiatives (42%) compared to NP (48% and 54%, respectively) but differences were not statistically significant ( $X^2 = 3.792$ ; $df = 1$ ; $p = 0.052$ and $X^2 = 0.900$ ; $df = 1$ ; $p = 0.343$ , respectively). Four P were identified as supporting School Nutrition Programs, including Coca-Cola and Danone who donate fruit juice and yogurt to Breakfast Club of Canada. Both companies along with McDonalds also sponsor sports for children < 12 years. These activities do not contravene their pledge since they do not apply to charitable activities.	No apparent Col: <ul style="list-style-type: none"> <li>• Affiliations: universities</li> <li>• Funding: none</li> <li>• One author received a small honorarium from the Stop Marketing to Kids Coalition.</li> </ul>
Vergeer (2019) <sup>77</sup>	CAI (Canada)	To compare the marketing of unhealthy products to children on Canadian websites of food companies with and without voluntary policies or commitments.	Cross-sectional (post, once). Spring-summer 2017	31 websites of 37 major companies in Canada [packaged food ( $n = 6$ ), beverage ( $n = 12$ ), and restaurant chains ( $n = 13$ )].	<ul style="list-style-type: none"> <li>• Child-directed products and marketing</li> <li>• Type and frequency of marketing techniques</li> </ul>	Overall, a significantly greater proportion of P marketed products to children on their websites, compared with NP.	<ul style="list-style-type: none"> <li>• Affiliations: universities</li> </ul>



Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
				[P: 14 (38%) companies; NP: 23]	Nutritional quality using data from company websites and packaging; classified using a nutrient profile model proposed by Health Canada for children marketing regulations. Focus on children: Y	Child-directed marketing appeared on 19 websites of 12 companies (32%), including 9 P. Websites featured products and marketing strategies that are appealing to children. Of the 217 products marketed to children, 97% exceeded Health Canada's proposed 5% Daily Value threshold for saturated fat, sodium, and/or sugars; 73% of which were products from 9 P.	<ul style="list-style-type: none"> <li>Funding: Canadian Institutes of Health Research and U of Toronto</li> <li>An author has worked on research projects funded partly by Nestlé and the Dairy Farmers of Canada.</li> </ul>
<b>R-Advertising and Marketing control: food packaging (n = 1)</b>							
Vaala (2020) <sup>81</sup>	CFBAI (USA)	To explore sugar content and child oriented promotional features on packaging among ready-to-eat cereal by manufacturers participating in the CFBAI in the US marketplace.	Cross-sectional (post, once) September 2018	159 ready to eat dry cereal boxes from two major retail stores. [P: 110 (69%) cereal boxes, including 17 listed as meeting the CFBAI nutritional criteria; NP: 49]	<ul style="list-style-type: none"> <li>Sugar content per serving size and ounce</li> <li>Serving size suggested</li> <li>Cereal density (grams of cereal per cup measure)</li> <li>Frequencies and number of promotional features per box.</li> </ul> Using information from packages. Focus on children: Y	Cereals listed by manufacturers as meeting CFBAI nutritional criteria had significantly smaller suggested serving sizes than CFBAI-not listed cereals and cereals produced by NP (F <sub>2,158</sub> = 8.34, p < 0.001). CFBAI-cereal listed products also tended to have lower cereal density on average compared with CFBAI-cereal not listed and NP cereals, but these differences were not statistically significant. Games/activities, trade characters, and displaying children on the box were most common among cereals classified as CFBAI-cereal listed, followed by CFBAI-cereal not listed (p < 0.001, respectively). NP companies did not use trade characters (mascots), licensed media spokes characters, or images of children to market RTE cereals.	<ul style="list-style-type: none"> <li>Affiliations: university and NR</li> <li>Funding NR</li> <li>Declared not having Col.</li> </ul>

continued

TABLE 15 Study characteristics and results ( $n = 16$ ) (continued)

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
<b>I-Product reformulation by manufacturers (<math>n = 2</math>)</b>							
Levi (2018) <sup>63</sup>	FHD (Australia)	To evaluate whether product soups under the FHD met the December 2014 sodium reduction targets and to compare P soups to NP soups.	Repeat cross-sectional (post-post). Between August and December in 2011, 2012, 2013, 2014	1153 dry, canned, and chilled soups from the same four grocery retail stores in Sydney, Australia. [P: In 2014: 68 (77%) dry and 125 (59%) wet soups from 7 companies; NP: In 2014: 20 dry and 87 wet; N companies NR]	Sodium content of 'wet and condensed' and of 'dry' soups 'as consumed'. Using nutrition information from the George Institute Branded Food Composition Database (which uses front-of-pack labels, nutrition information panels and ingredients lists). Focus on children: N	There were a greater proportion of products below the FHD sodium targets for P compared with NP (both dry and wet soups – illustrated in figures only). In 2014, the proportion of dry soups from P that met the targets compared to when they entered the market significantly increased ( $p \leq 0.001$ ). There was an increase in products that met the FHD sodium targets from NP companies, but the increase was non-significant. For wet products, there was a small but not significant increase from 70% in 2011 to 76% in 2014 in the proportion of manufacturers meeting the target for both P and NP companies combined. There was no significant difference between N and NP.	No apparent Col: <ul style="list-style-type: none"> <li>• Affiliations: universities</li> <li>• Funding: National Health and Medical Research Council</li> <li>• Declared having no Col.</li> </ul>
Sparks <i>et al.</i> (2018) <sup>65</sup> Low (-)	FHD (Australia)	To assess the median Na levels of 2510 processed meat products, including bacon and sausages, available in major Australian supermarkets in 2010, 2013, 2015 and 2017, and assessed changes over time.	Repeat cross-sectional (post-post) (2010, 2013, 2015 and 2017)	2510 processed meat products in four major supermarkets in Australia. 2010: 181 (43%) P; 2017: 236 (35%) P. Nutrition data from the Australian FoodSwitch database	Na content of processed meat, of which five product categories have targets (P): bacon, ham/cured meat products, emulsified luncheon meats, wet savoury pasties and dry savoury pasties.	Median Na of P processed meats reduced by 11% ( $p < 0.001$ ) vs. no change in NP (median difference 6%, $p = 0.450$ ). It was 1010mg/100g in 2010 vs. 898mg/100g in 2017 for P and 765mg/100g in 2010 vs. and 717mg/100g in 2017 for all processed meat. A higher proportion of bacon, ham/cured meat products and wet savoury pasties met the targets between 2010 and 2017 ( $p < 0.001$ , $p = 0.012$ and $p = 0.006$ , respectively) while there were no change for emulsified luncheon meats ( $p = 0.363$ and dry savoury pasties ( $p = 0.111$ ).	<ul style="list-style-type: none"> <li>• Affiliations: university, Victorian Health Promotion Foundation, Heart Foundation.</li> <li>• Funding: National Health and Medical Research Council/National Heart Foundation, WHO, VicHealth, AUS National Health and Medical Research Council.</li> </ul>

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
Spiteri (2018) <sup>70</sup>	Healthier Australia Commitment (Australia)	To assess the healthfulness of new food products released into the Australian retail market in 2015, and whether HAC members released healthier food options compared to non-members.	Cross-sectional (post, once). Between January and December 2015	All new food and beverage products launched in Australia in 2015 that were indexed in Mintel's Global New Products Database ( $n = 4134$ ). [P: 297 (7%) products; NP: 3846; N companies NR]	Healthfulness according to: (1) The Healthy Choices Framework Victoria nutrient-based criteria (traffic lights), (2) The Australian Dietary Guidelines food-based criteria (core, discretionary, or other for products not edible on their own such as baking ingredients, herbs and spices) and (3) The NOVA Food Classification System level of processing criteria (minimally processed, culinary ingredients, processed, ultra-processed). Using data from the Mintel's Global New Products Database. Focus on children: N	P launched a significantly greater proportion of foods classified as red (59% vs. 51% for P and NP, respectively), discretionary (79% vs. 61%) and ultra-processed (94% vs. 81%), as well as significantly fewer green (8% vs. 15%), core foods (18% vs. 36%) and minimally processed (0% vs. 6%) (all $p < 0.001$ ).	<ul style="list-style-type: none"> <li>Declared affiliations with WHO Collaborating Centre on Population Salt Reduction.</li> <li>Affiliations: university + unclear</li> <li>Funding: Canadian Institutes of Health Research and Deakin University</li> <li>Declared having no Col.</li> </ul>

continued

TABLE 15 Study characteristics and results (*n* = 16) (continued)

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
<b>S-Food retail and service sector (<i>n</i> = 1)</b>							
Wellard-Cole (2019) <sup>73</sup>	QSRI (Australia)	To compare the nutrient composition of children's meals in fast-food chains with children's daily requirements and recommendations and the food industry's own criteria for healthier children's meals; and determine whether the situation has changed since 2010.	Repeat cross-sectional (post, post) November 2010 and May 2016	289 children's meals (main + drink) from 12 large fast-food chains. [P: 172 (60%) meals from 6 chains; NP: 117 meals from 6 chains]	Nutrition composition of children's meals compared with 30% (recommended contribution for a meal) and 100% of children's daily recommendations and requirements for 4-, 8- and 13-year-olds, and compliance with the food industry's own criteria. Nutrition information from fast-food chains' websites, store visits, printed materials, menu boards, phone/e-mails to outlets. Focus on children: Y	<p>For 4-year-olds, most P and NP meals exceeded 30% of daily recommendations for energy (P: <i>n</i> = 118, 69%; NP: <i>n</i> = 70, 60%) and sugar (P: <i>n</i> = 115, 67%; NP: <i>n</i> = 72, 62%). A higher proportion of NP meals compared to P meals exceeded 30% of daily recommendations for saturated fat (<i>n</i> = 90, P: 52%; NP: <i>n</i> = 83, 71%); and 30% of the upper level of intake for Na (P: <i>n</i> = 152, 88%; NP: <i>n</i> = 105, 90%, 2.1%) P meals [and 15 (13%) NP meals exceeded 100% of the Na upper limit].</p> <p>For 9-year-olds, similar trends were observed, with a greater proportion of P than NP exceeding the 30% recommendation for energy (P: <i>n</i> = 76, 44%; <i>n</i> = 37, 32%), and sugars (P: <i>n</i> = 93, 54%; NP: <i>n</i> = 59, 50%), while a greater proportion of NP exceeded those for saturated fat (P: <i>n</i> = 65, 38%; <i>n</i> = 73, 62%) and upper Na limit (P: <i>n</i> = 152, 88%; <i>n</i> = 105, 90%). Again, 2 (1%) P meals [and 15 (13%) NP meals exceeded 100% of the Na upper limit].</p>	<p>No apparent Col:</p> <ul style="list-style-type: none"> <li>• Affiliations: university and Cancer Council New South Wales</li> <li>• Funding: None</li> <li>• Declared having no Col.</li> </ul>

Author (date)	Policy name (country where assessed)	Study aim	Study design; data collection dates	Sample (N P; N NP)	Outcomes compared between P and NP and data sources	Results comparing P and NP	Reported funding, competing interests and affiliations
						<p>For 13-year-olds, trends were slightly different with a greater proportion of P exceeding again the 30% recommendation for energy (P: <math>n = 20</math>, 12%; <math>n = 6</math>, 5%) but also for salt (P: <math>n = 110</math>, 64%, NP: <math>n = 36</math>, 31%). The reverse was observed for saturated fat (P: <math>n = 24</math>, 14%; NP: 37, 32%) and sugars (P: <math>n = 46</math>, 27%; NP: <math>n = 43</math>, 37%). Only five (4%) NP meals exceeded 100% of the Na upper limit.</p> <p>Most children's meals from P restaurants did not meet the QSRI's own definition of a healthy children's meal that could be marketed to children (P: <math>n = 141</math>, 82% for 4- and 8-year-olds; <math>n = 131</math>, 76% for 13-year-olds), especially for sodium. Between 2010 and 2016, the proportion of meals not meeting QSRI's criteria for any nutrient did not change nor for those exceeding 30% or 100% of children's recommendations for energy or nutrients (all <math>p &lt; 0.05</math>, data not shown)</p>	

Col, conflict of interest; FLIP, Food Label Information Program; NR, not reported; OFCOM, office of communications; P, participants; PAHO, Pan-American Health Organization. a Moran (2017): Results were also provided for 2012–3 and 2012–4, but we extracted information for the most recent year (2012–5).

The QSRI in Australia was investigated in three studies (one moderate, two low quality). Effects on television advertising practices for unhealthy foods to children were either mixed or worse among participants.<sup>71,72</sup> Wellard-Cole<sup>73</sup> found that fewer children's meals from fast-food chains exceeded recommendations for saturated fat but that the proportions of meals exceeding calorie recommendations were greater among participants and inconclusive for sugar and sodium (no inferential statistics performed).

Lastly, a study by Robinson *et al.*<sup>57</sup> (unclear quality) investigated whether the 16 restaurant chains that had signed the calorie labelling pledge in the Public Health RD in England tended to display calorie labels and meet the seven labelling criteria compared to 88 NP restaurant chains. While a greater proportion of participating chains displayed labels, only one participating and two NP chains provided calorie labelling for all items sold, and none fulfilled all criteria.

[Tables 16](#) and [17](#) present a summary of the nine categories of outcomes assessed by direction of effect, sample size and study quality. The shape of the triangles illustrates the overall direction of result independently from statistical significance while their size reflects the final sample size of intervention group (participants). The subscript numbers represent the number of outcomes within each category synthesis. The colours refer to the study's overall study quality.

Despite the effect direction tables not considering effect size nor precision estimates, they show that there is no clear evidence to suggest that policies designed as voluntary approaches led by commercial actors to reduce advertising or other promotion of unhealthy products to children, improve the nutritional composition of food and beverages, encourage calorie menu labelling in chain restaurants, or reduce marketing targeting children on food packages. When comparing participants to non-participants, the direction of effect or association for most outcomes was either inconclusive or worse for participants. No pattern could be noticed with overall study quality, country, policy category or type of outcome assessed.

An examination of the effect direction plots (see [Tables 16](#) and [17](#)) suggests that the results do not vary by study quality.

## Conclusions

From the available evidence reviewed across 16 studies evaluating nine voluntary approaches by private actors, it would appear that there is limited evidence to suggest that policies designed as voluntary approaches led by commercial actors are effective at reducing advertising and other promotion of unhealthy products to children, improving the nutritional composition of food and beverages, encouraging calorie menu labelling in chain restaurants, or reducing marketing targeting children on food packages.

**TABLE 16** Direction of effects between P and NP: outcomes relating to advertising and marketing to children (n = 9 studies)

Author (year)	Study design N years between policy implementation and evaluation; study quality	Sample size of participants (P) group (% of total sample)	TV advertising to children: frequency of adverts for unhealthy foods and advertising practices	TV advertising to children: nutrition profile and types of products shown	Online marketing to children: presence of marketing of unhealthy food and marketing practices	Online advertising to children: nutrition profiles and types of products shown	Corporate social activities in nutrition and physical activity: nature and targeted populations
<b>CFBAI (Canada) (n = 4)</b>							
Vergeer (2019) <sup>77</sup>	CS; 10 years Moderate (+)	14 (38%) companies;			▽ <sub>1</sub> (presence of child- directed marketing)	▽ <sub>3</sub> (sat fat, Na, sugar; sample size: over 158 products from P)	
Potvin Kent (2018) TV <sup>74</sup>	RCS-PP; 6–9 years Low (-)	120 (50%) adverts in 2013, 187 (56%) in 2016		△ <sub>1</sub> (UK OFCOM criteria, CP) ◁▷ <sub>4</sub> (PAHO criteria, CP)			
Potvin Kent (2018) Online <sup>76</sup>	CS; 8–9 years Moderate (+)	~35.5 million (79%) adverts				▽ <sub>1</sub> (ultra-processed food) ▽ <sub>1</sub> (UK OFCOM criteria) ▲ <sub>5</sub> (PAHO criteria) ▽ <sub>7</sub> 'Negative' nutrients per 100 g: kcal, fat, sugar, salt ◁▷ <sub>2</sub> 'Positive' (nutrients per 100 g: fibre, protein)	
							continued

**TABLE 16** Direction of effects between P and NP: outcomes relating to advertising and marketing to children (n = 9 studies) (continued)

Author (year)	Study design N years between policy implementation and evaluation; study quality	Sample size of participants (P) group (% of total sample)	TV advertising to children: frequency of adverts for unhealthy foods and advertising practices	TV advertising to children: nutrition profile and types of products shown	Online marketing to children: presence of marketing of unhealthy food and marketing practices	Online advertising to children: nutrition profiles and types of products shown	Corporate social activities in nutrition and physical activity: nature and targeted populations
Potvin Kent (2020) <sup>75</sup>	CS; 9 years Moderate (+)	36 (75%) CSR activities from 18 companies					▼ <sub>1</sub> (proportion of nutrition- related initiatives) ◄◄ <sub>1</sub> (proportion of child- targeted initiatives)
<b>CFBAI (USA) (n = 1)</b>							
Harris (2018) <sup>80</sup>	CS 9 years Unclear (?)	9 companies (28%)	▼ <sub>2</sub> (adverts' frequency- two age groups, CP).				
<b>EU pledge (n = 2)</b>							
Landwehr (2020) <sup>79</sup>	RCS-PP 4–11 years Moderate (+)	239 (59%) adverts in 2011, 295 (71%) in 2014	◄◄ <sub>6</sub> (share in commercial and CP, N spots in commercial and CP, N products, adverts length)	△ <sub>1</sub> (UK OFCOM criteria) ◄◄ <sub>1</sub> (PAHO criteria) ◄◄ <sub>2</sub> (presence of sweets and fast-food brands, General audience and CP)			
Neyens (2017) <sup>78</sup>	CS; Unclear, potentially 7 years Low (-)	15 (31%) websites				◄◄ <sub>3</sub> (online protection) ◄◄ <sub>2</sub> (marketing tactics)	▼ <sub>1</sub> (score based on UK OFCOM)



Author (year)	Study design N years between policy implementation and evaluation; study quality	Sample size of participants (P) group (% of total sample)	TV advertising to children: frequency of adverts for unhealthy foods and advertising practices	TV advertising to children: nutrition profile and types of products shown	Online marketing to children: presence of marketing of unhealthy food and marketing practices	Online advertising to children: nutrition profiles and types of products shown	Corporate social activities in nutrition and physical activity: nature and targeted populations
<b>QSRI and RCMI (Australia) (n = 2)</b>							
Watson (2017) <sup>72</sup>	CS; 6 years Moderate (+)	NR (for both N companies and adverts)	▼ <sub>2</sub> (adverts frequency, RCMI and QSRI, general audience and CP)				
Smithers (2019) <sup>71</sup>	CS; 8 years Low (-)	NR (for both N companies and adverts)	◄◄ <sub>2</sub> (adverts frequency, CP and children's peak time)				

CS, cross-sectional; CSR, corporate social responsibility; Na, sodium; RCS-PP, repeat cross-sectional post-post; Sat fat, saturated fat.

#### Notes

Effect direction: the triangles illustrate the overall direction of effect on the outcomes independently from statistical significance. Upward ▲ = greater positive outcome for the participants, downward arrow ▼ = worse outcome for the participants, sideways arrow ◄◄ = no change/mixed effects/conflicting findings between the groups. Sample size: Final sample size in intervention group (policy participants). Large arrow ▲ > 300; medium arrow △ 50–300; small arrow ▲ < 50. Subscript numbers: Number of outcomes within each category synthesis.

It is not possible to add numerical results in the summary effect direction table because each triangle represents a summary of multiple directions of effects for different outcomes within that category of outcomes.

**TABLE 17** Direction of effects between P and NP: outcomes relating to food offered in the retail and food service sectors (n = 6 studies)

Author (year)	Study design; N years between policy implementation and evaluation; Study quality	Sample size of participants (P) group (% of total sample)	Restaurant food and beverages: calorie labelling display	Children's meals in restaurants: nutrient content	Manufactured products: nutrient content and presence of child-directed marketing on packaging
<b>CFBAI (USA) (n = 1)</b>					
Vaala (2020) <sup>81</sup>	CS 12 years Low (-)	110 (69%) cereal boxes, including 17 listed as meeting the CFBAI nutritional criteria			<p>▽<sub>2</sub> (P-listed cereals: smaller serving sizes and lower cereal density than other P and NP)</p> <p>▽<sub>3</sub> (marketing practices more present on P-listed cereals, than on other P, compared to NP)</p>
<b>FHD (Australia) (n = 1)</b>					
Levi (2018) <sup>63</sup>	RCS-PP 2-5 years Unclear (?)	68 (77%) dry and 125 (59%) wet soups from five companies in 2014			△ <sub>2</sub> (dry and wet soups – Na)
Sparks (2018) <sup>65</sup>	RCS-PP 1-8 years Low (-)	181 (43%) processed meats in 2010 and 236 (35%) in 2017. Five product categories have targets			<p>◁▷<sub>5</sub> (Na in five product categories)</p> <p>△<sub>1</sub> (Na overall)</p>
<b>Healthier Australia Commitment (Australia) (n = 1)</b>					
Spiteri (2018) <sup>70</sup>	CS 3 years Unclear (?)	297 (7%) products			<p>▽<sub>1</sub> (Healthy Choices Framework Victoria)</p> <p>▽<sub>1</sub> (Australian Dietary Guidelines)</p> <p>▽<sub>1</sub> (NOVA categories)</p>

Author (year)	Study design; N years between policy implementation and evaluation; Study quality	Sample size of participants (P) group (% of total sample)	Restaurant food and beverages: calorie labelling display	Children's meals in restaurants: nutrient content	Manufactured products: nutrient content and presence of child-directed marketing on packaging
<b>Kids LiveWell (USA) (n = 1)</b>					
Moran (2017) <sup>82</sup>	RCS-PP 1–4 years Low (-)	2002 menu items from 15 restaurants: 890 (47%) beverages, 639 (46%) entrées, 321 (82%) side dishes and 152 (84%) desserts		 (calories) (sodium) (saturated fat) (All for entrées, sides and desserts; also beverages for calories)	
<b>QSRI and RCMI (Australia) (n = 1)</b>					
Wellard-Cole (2019) <sup>73</sup>	RCS-PP 1–7 years Low (-)	172 (60%) meals from 6 chains		 (calories) (saturated fat) (sugar) (sodium) (all for 4-, 8-, 13-year-olds)	
<b>RD (England, UK) (n = 1)</b>					
Robinson <i>et al.</i> (2019) <sup>57</sup>	CS 7 years Unclear (?)	16 (15%) restaurants chains	 (displaying labels, all labelling criteria)		

CS, cross-sectional; Na, sodium; RCS-PP, repeat cross-sectional post–post; Sat fat, saturated fat.

#### Notes

Effect direction: The triangles illustrate the overall direction of effect on the outcomes independently from statistical significance. Upward ▲ = greater positive outcome for the participants, downward ▼ = worse outcome for the participants, sideways arrow ◄► = no change/mixed effects/conflicting findings between the groups. Sample size: Final sample size in intervention group (policy participants). Large arrow ▲ > 300; medium arrow △ 50–300; small arrow ▲ < 50. Subscript numbers: number of outcomes within each category synthesis.

It is not possible to add numerical results in the summary effect direction table because each triangle represents a summary of multiple directions of effects for different outcomes within that category of outcomes.



# Chapter 7 Systematic review on the cost-effectiveness of policies to improve food environments and population diet

## Introduction

This paper describes a systematic review of literature on the cost-effectiveness of real-world regulatory, voluntary and PPP policies to improve food environments. These economic evaluation studies provide evidence to identify cost-effective interventions and serve as the foundation for the delivery of population-level intervention.

## Methods

### *Literature search strategy and eligibility criteria*

This systematic review builds on the primary economic studies (e.g. cost-effectiveness, cost-benefits) that were identified as part of the systematic evidence map (see [Chapter 3](#)). Economic simulations and projections were eligible if the data used for measuring effectiveness met the overarching eligibility criteria. Given that only four evaluations of cost-effectiveness were retrieved, two additional searches were conducted in MEDLINE (Ovid) to explore whether eligible studies had been missed (see [Appendix 6, Tables 31 and 32](#)): a very comprehensive and sensitive search on FOPL based on the search strategy by Croker *et al.*<sup>43</sup> and a less sensitive search on fat, salt and sugar reformulation. These two topics were chosen because of their higher odds of being less well captured by the original literature search given the focus of the latter on whether policies were regulatory, voluntary or PPPs. If more than one additional eligible study was to be identified in each search, additional searches would have been conducted for the other policy areas covered in the evidence map. However, since none was identified, this was deemed unnecessary. Lastly, the reference lists of the included studies were screened as well as those of evidence syntheses on cost-effectiveness excluded from the overview of reviews (see [Chapter 4](#)).

### *Data extraction*

Information on the policies (name, topic, country, policy level, governance approach), study methods for assessing effectiveness (population, study design, mechanism, diseases considered), methods for assessing costs (types of costs considered, choice of model) and results (incremental health outcomes and costs, conclusion on whether a policy was considered cost saving) was extracted in a standardised extraction form by one reviewer (CL) and checked by another (LB). These fields were inspired by the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist.<sup>84</sup> Cost estimates were inflated and/or converted in 2020 international dollar using country-specific gross domestic product (GDP) deflator index and purchasing power parity conversion factor in 2020 from World Bank Databank.<sup>85,86</sup>

### *Quality appraisal and data synthesis*

The methodological quality of the studies was assessed by two reviewers independently (CL, LB) using Drummond's 10-criteria checklist version 2015<sup>87</sup> for assessing economic evaluations. Each criterion was assigned 'Yes', 'No' or 'Can't Tell'. Disagreements were resolved by discussion.

Data were synthesised in a descriptive manner using the categories of information extracted. The initial plan was to summarise the measures of costs and cost-effectiveness using the policy areas described

in the NOURISHING framework.<sup>18</sup> However, this proved impractical because of the small number of studies included. We had also planned to pool outcome estimates from comparable studies in a random-effect model meta-analysis to characterise average intervention impacts, but this was not possible due to the aggregation of the outcomes in broader indicators in some studies and the diversity of cost measures used.

## Findings

### Characteristics of included studies

As mentioned above, of the 483 primary studies included in the systematic evidence map, only four were economic evaluations of real-world policies.<sup>88-91</sup> No other evaluations were identified in the additional literature searches nor by screening references. [Table 18](#) provides an overview of the policy interventions assessed in the four studies. These include two studies of the SSB tax in Mexico.<sup>88,91</sup> This SSB tax is a regulatory government intervention that was implemented as an excise tax of 1 peso per litre in 2014. This tax was added to non-alcoholic beverages with added sugar.<sup>88</sup> The third study assessed voluntary salt reformulation in the context of the Public Health RD in England.<sup>89</sup> The Public Health RD was a PPP in operation in England from 2011 to 2017. It aimed to foster collaboration between the government, business and voluntary sectors to improve population health. One of the pledges launched under the RD was to reduce population-level salt intake. The fourth study was on the HSR Labelling Scheme in Australia.<sup>90</sup> This is a voluntary FOP label initiative endorsed by the New Zealand and Australian governments. Packaged food and drink products are given a rating that ranges from half a star (least healthy) to five stars (most healthy).

### Quality appraisal

The quality appraisal of the four included studies is reported in [Table 18](#). All studies met at least 5 out of the 10 Drummond checklist criteria. Mantilla Herrera *et al.*<sup>90</sup> was assessed to be the highest quality because it was the only study to receive positive answers to all assessment questions. The other three studies<sup>88,89,91</sup> were assessed negatively on regarding whether the research question was well-defined as the prospective of their analysis was not clearly stated. Without a clear specification of the prospective taken, it was also not possible to judge if all the important and relevant costs and consequences for each alternative were identified in these three studies. By contrast, using a limited societal perspective, Mantilla Herrera *et al.*<sup>90</sup> considered the costs to the government and the food industry but not other wider societal costs such as productivity loss. The earlier study on SSB tax in Mexico<sup>91</sup> received the least number of positive answers as it did not clearly explain the competing alternative nor justify the effectiveness measure used. Additionally, no incremental analysis of costs and consequences were performed in this study, limiting the comparability of their results to other studies or any pre-determined willing-to-pay (WTP) thresholds.

**TABLE 18** Policy intervention characteristics

First author, year	Policy name	Country	Year started	Policy level	Governance approach	Policy area
Basto-Abreu, 2019 <sup>88</sup>	SSB tax	Mexico	2014	National	Regulatory	SSB tax
Laverty, 2018 <sup>89</sup>	Public Health RD	England	2011	England only	PPP – voluntary	Reformulation – salt
Mantilla Herrera, 2018 <sup>90</sup>	HSR Food Labelling (voluntary scenario)	Australia	2014	International (Australia and New Zealand)	Voluntary	FOPL
Sanchez-Romero, 2016 <sup>91</sup>	SSB tax	Mexico	2014	National	Regulatory	SSB tax

### Measures of effectiveness and cost

Table 19 highlights the heterogeneity in the included studies both in terms of the study populations and methods used for assessing effectiveness of the interventions. Two of the four studies examined the impact of the interventions on both children and adults,<sup>89,90</sup> while the other two focused on adults aged 30 years or older.<sup>88,91</sup> In particular, the study on FOPL in Australia by Mantilla Herrera *et al.*<sup>90</sup> modelled the cost-effectiveness over the lifetime of the population of ages while the other studies used a shorter time horizon approach (10 years or less).

For measuring effectiveness, three studies used evidence obtained from quasi-experimental designs to identify policy changes outside the direct control of researchers: Mantilla Herrera *et al.*<sup>90</sup> and Basto-Abreu *et al.*<sup>88</sup> both used a difference-in-difference approach that included control groups while Laverty *et al.*<sup>89</sup> used an interrupted time-series design without a control group. By contrast, Sanchez-Romero *et al.*<sup>91</sup> assessed scenarios of effects using existing estimates of price elasticity of demand in a state transition model. The evidence around causality was stronger in the first two studies<sup>88,91</sup> as the difference-in-difference approach they utilised the trend in the control group to forecast the trend in the intervention group that would have been expected if the intervention had not happened. The actual causal estimate was then obtained by comparing the outcomes before and after the change for the intervention group to the corresponding difference for the control group, allowing to infer causality. By comparison, the measure of effectiveness in Laverty *et al.*<sup>89</sup> was obtained from quasi-experimental designs without a control group, which makes it more prone to bias by confounding events that took place during the same time period as the RD. Furthermore, there is a lack of longitudinal data on salt intakes in the same people; thus, causality cannot be ascribed in the effectiveness measure of RD. As for Sanchez-Romero *et al.*,<sup>91</sup> although the price elasticity of demand used reflected real-world consumer responses to price changes, it was not an actual causal estimate of the effect of the Mexican SSB tax. Additional limitations in the measures of effectiveness in the studies include the lack of data on

TABLE 19 Quality appraisal of the included studies

Criteria	Basto-Abreu 2019 <sup>88</sup>	Laverty 2019 <sup>89</sup>	Mantilla Herrera 2018 <sup>90</sup>	Sanchez-Romero 2016 <sup>91</sup>
1. Was a well-defined question posed in answerable form?	No	No	Yes	No
2. Was a comprehensive description of the competing alternatives given?	Yes	Yes	Yes	No
3. Was the effectiveness of the programmes or services established?	Yes	Yes	Yes	No
4. Were all the important and relevant costs and consequences for each alternative identified?	Can't tell	Can't tell	Yes	Can't tell
5. Were costs and consequences measured accurately in appropriate physical units prior to valuation?	Yes	Yes	Yes	Yes
6. Were costs and consequences valued credibly?	Yes	Yes	Yes	Yes
7. Were costs and consequences adjusted for differential timing?	Yes	Yes	Yes	Yes
8. Was an incremental analysis of costs and consequences of alternatives performed?	Yes	Yes	Yes	No
9. Was uncertainty in the estimates of costs and consequences adequately characterised?	Yes	Yes	Yes	Yes
10. Did the presentation and discussion of study results include all issues of concern to users?	Yes	Yes	Yes	Yes
<b>Source</b> CHEERS checklist. <sup>84</sup>				

purchases outside of stores (i.e. Basto-Abreu 2019<sup>88</sup>) and assumptions of consumer responses to the intervention.<sup>90,91</sup>

In all four studies, changes in the distribution of weight and/or systolic blood pressure were used as intermediate outcomes to evaluate the impact of the policy interventions on CHD and stroke. All but Laverty *et al.*<sup>89</sup> also considered diabetes. Other diet-related health outcomes evaluated included various cancers, knee and hip osteoarthritis, and non-cardiovascular disease mortality.

Methods for assessing policy effectiveness are summarised in [Table 20](#). Two studies sought to apply quality-adjusted life-years (QALYs) or health-adjusted life-years (HALYs) as outcomes.<sup>88,90</sup> These are commonly used metrics that facilitate comparison between studies and different types of interventions and diseases. Even though all studies considered CHD and strokes, two<sup>89,90</sup> did not explicitly report the number of cases reduced for these diseases. Both studies on the Mexican SSB tax showed reduction in the cases of CHD, strokes and diabetes but with quite different magnitudes of reduction. This could be due to differences in the underlying measurements of effectiveness as well as the mechanism used to model these health outcomes. The HSR labelling in Australia was predicted to result in incremental health benefits equating to 4207 HALYs (95% UI 2438 to 6081). While all health-related outcomes improved in studies assessing the Mexican SSB tax and HSR labelling, the study on the RD in England found the reverse relationship: their results suggest that the partnership has increased the CVD and cancer burden as the decline in population-level salt intake slowed down after its implementation in 2011.

There were variations in the types of other costs assessed across the four studies although they all estimated healthcare cost implications of the intervention. Basto-Abreu<sup>88</sup> and Mantilla-Herrera<sup>90</sup> assessed costs associated with implementing the interventions for governments, and the latter also considered potential costs to the food industry. Note that neither study on SSB tax considered potential societal costs and benefits from the increase in government revenue. This could be because the included studies may have taken different analytical perspectives (e.g. the healthcare sector, the government, the society as a whole and etc.<sup>95</sup>). For instance, productivity changes are typically not considered under the healthcare sector perspective, which were also excluded under the limited societal perspective taken in the Mantilla-Herrera's study on HSR rating in Australia.<sup>90</sup> Laverty *et al.*<sup>89</sup> was the only study to assess the broader economic implications by estimating costs included by changes in productivity. However, it did not consider implementation costs. While not clearly stated, Sanchez-Romero 2016<sup>91</sup> might have adopted a healthcare sector perspective and hence only healthcare costs were assessed.

### **Cost and cost-effectiveness of interventions**

The incremental health and cost outcomes are summarised in [Table 21](#). Overall, with their positive health outcomes, both the SSB tax in Mexico and FOPL in Australia identified reductions in healthcare costs. In addition to the differences in the measure of effectiveness and mechanism shown in [Table 3](#), Basto-Abreu *et al.*'s study<sup>88</sup> on the Mexican SSB tax used an estimated cost per patient that was lower than the estimate used by Sanchez-Romero *et al.*,<sup>91</sup> which may further explain the differences between these two studies in healthcare cost savings achieved by the SSB tax. Laverty *et al.* showed that ongoing reductions in salt intake preceding the RD slowed following its introduction, leading to increased rather than decreased healthcare costs. Based on the costs assessed, most studies showed a substantial societal economic benefit of population-level interventions aimed at promoting healthy diets. The FOPL intervention in Australia was found to be cost-effective relative to a WTP threshold of \$40,861. Basto-Abreu 2019<sup>88</sup> found the Mexican SSB tax to be cost-saving as the healthcare costs saved would outweigh its implementation costs. For each dollar spent, the SSB tax was shown to save \$7.28 in future healthcare costs. Sanchez-Romero 2019 only assessed healthcare cost savings and did not discuss the cost-effectiveness of the tax. Given their even larger estimates of healthcare cost savings, using their data it would be highly likely for the SSB tax to be even more cost-effective if the implementation costs were assumed to be the same as those estimated by Basto-Abreu 2019.<sup>88</sup> The costs of implementing the



TABLE 20 Methods for assessing policy effectiveness

Author, year	Study population (time horizon, discount rate)	Measurement of effectiveness			Diet-related diseases considered			
		Study design	Limitations	Mechanism	CHD	Stroke	Diab.	Others
Basto-Abreu, 2019 <sup>88</sup>	2014 Mexican population aged 2–100 (10 years, 3%)	7.6% reduction in SSB purchases in store 2 years after the tax was implemented (2016). (Difference-in-difference study.) <sup>92,93</sup>	The study included only beverages purchased in stores, not those sold in restaurants or other venues.	Changes in the BMI distribution, prevalence of obesity in the population and the resulted changes in the incidence obesity-related diseases were projected from the reduction in SSB intake.	X	X	X	Breast cancer; Colorectal cancer; Endometrial cancer; Kidney cancer
Laverty, 2019 <sup>89</sup>	English adult aged 30–84 (2011–8, 3.5%)	Annual reductions in salt intake were reduced between 2011 and 2014 by 0.11 g/day among men and 0.07 g/day among women. (Interrupted-time-series study using 24 hours' urine excretion.)	A lack of longitudinal data collections on salt intakes in the same people means that causality cannot be ascribed.	Impacts of salt intake changes were estimated using effect sizes of the association between salt intake and health outcomes (using systolic blood pressure as an intermediate for CVD outcomes).	X	X		Gastric cancer
Mantilla Herrera, 2018 <sup>90</sup>	2010 Australian population, all ages (over the lifetime, 3%)	Average change in energy density of – 7.11 kJ/100 g, and in daily energy intake of –0.98 kJ/day between 2013 and 2016. (Difference-in-difference study of the energy density of HSR and non-HSR labelled products.)	Assumption of no changes in consumers' behaviour in response to voluntary FOPL system.	Changes in average energy density were used to estimate the change in average energy intakes and the resulting changes in the weight distribution of the population and the incidence, prevalence and mortality of obesity-related diseases.	X	X	X	Breast cancer; Colorectal cancer; Endometrial cancer; Kidney cancer; Knee and hip osteoarthritis <sup>a</sup>
Sanchez-Romero, 2016 <sup>91</sup>	2010 Mexican adults aged 35–94 (2013–22, 3%)	A 10% decrease in SSB consumption (informed by an observational study on SSB purchases and existing estimates of soda price elasticity in Mexico).	The effectiveness measure was not derived directly from quasi-experimental studies and hence causality cannot be ascribed.	Effects of SSB consumption on three factors related to CVD: diabetes incidence, mean BMI, and mean systolic blood pressure were modelled using a 39% calorie compensation rate.	X	X	X	Non-CVD death

a Based on CRE-Obesity model.<sup>94</sup>

TABLE 21 Incremental health and cost outcomes

Author, year	Incremental health outcomes	Incremental costs			Cost-effectiveness metric	Cost-effective?
		Healthcare costs	Implementation costs	Productivity losses		
Basto-Abreu, 2019 <sup>88</sup>	<ul style="list-style-type: none"> <li>▼ 7210 cases of CHD</li> <li>▼ 3990 cases of stroke</li> <li>▼ 61,340 cases of diabetes</li> <li>▼ 695 cases of cancer</li> <li>▼ 5840 DALYs</li> <li>▲ 918 life-years</li> <li>▲ 55,300 QALYs</li> </ul>	-\$167.7 m	+\$44.2 m (Government)		\$7.3 saved per dollar spent on its implementation (95% CI: 3.8 to 11.8)	Yes <sup>a</sup>
Lavery, 2018 <sup>89</sup>	<ul style="list-style-type: none"> <li>▲ 9900 cases of CVD</li> <li>▲ 710 CVD deaths</li> <li>▲ 1500 cases of gastric cancer</li> <li>▲ 610 gastric cancer deaths</li> </ul>	+\$169.7 m		+\$72.5 m	The incremental economic impact from 2011 to 2018 was approximately \$246.8 m (IQR: 135.8–354.8 m)	No
Mantilla Herrera, 2018 <sup>90</sup>	<ul style="list-style-type: none"> <li>▲ 4207 HALYs</li> </ul>	-\$34 m	+\$37.7 m (Industry and Government)		\$1412.14 per HALY (95% UI: dominant to 8536.6)	Yes (assuming a WTP threshold of \$40,861 per HALY)
Sanchez-Romero, 2016 <sup>91</sup>	<ul style="list-style-type: none"> <li>▼ 46,300 cases of CHD</li> <li>▼ 9300 cases of CHD death</li> <li>▼ 6200 cases of strokes</li> <li>▼ 1600 cases of stroke death</li> <li>▼ 189,300 cases of diabetes</li> <li>▼ 18,00 cases of all-cause death</li> </ul>	-\$1094.3 m				Unclear

IQR, interquartile range; UI, uncertainty interval.  
a Cost saving.

**Note**

All monetary values are inflated to 2020 international dollar using country-specific GDP inflator and the purchasing power parity conversion factor in 2020 from the World Bank.

RD were not assessed, but the RD in England was not cost-effective at improving population health, as a result of the additional healthcare costs identified.

## Conclusions

Two studies of the Mexican SSB tax, and one for the voluntary government-led HSR front-of-pack labelling intervention in Australia suggested positive impacts. The fourth one reported a lack of effectiveness and cost-benefit for the PPP intervention to reduce salt consumption in England as part of the Public Health RD. There is a pressing need to build on the extensive literature on the effectiveness of interventions with high-quality evidence on cost-effectiveness, to support meaningful action to tackle the scourge of diet-related ill health.



# Chapter 8 Qualitative evidence synthesis of policy process in regulatory, voluntary and public–private partnership approaches to improve food environments and population diet

## Introduction

This chapter describes the qualitative evidence synthesis of studies focusing on the policy process leading to regulatory, voluntary or PPP approaches, reporting barriers and facilitators and exploring more in-depth understanding of key actors and factors.

## Methods

We followed guidance from Flemming *et al.* (2018)<sup>96</sup> to review qualitative studies, aiming to gain a greater understanding of phenomena of interest.

### *Literature search strategy and eligibility criteria*

We included qualitative and mixed-methods studies (e.g. that conducted interviews, focus groups, qualitative document analyses) drawn from the systematic evidence map (see [Chapter 3](#)). To be included in this review, studies had to have assessed factors influencing a national policy process. We included papers published between 2010 and 2020, as well as studies focused on local (city, state – UK only) policies. Studies were screened by two reviewers (CK and MP).

### *Data extraction*

We documented policy type, method and participant characteristics. We extracted information relating to reported barriers and facilitators of policy design and implementation, decision-making processes, the use of evidence or particular strategies, and any information that would help gain deeper understanding about some of the findings emerging. Data were extracted by one reviewer in EPPI-Reviewer and checked by another.

### *Quality appraisal*

Each included study was independently appraised by two team members using the CASP Checklist for qualitative studies. Studies that received 'no' or 'can't tell' for the two filter questions that begin CASP would be excluded. No studies were weighted or excluded based on the appraisal results. We also checked for conflict of interests in terms of industry funding.

### *Data synthesis*

We synthesised the data using a narrative review approach to summarise findings and report on overarching themes.

## Findings

### *Database search*

A total of 91 relevant records were identified. We retrieved full text for all 91. Of these, 59 were excluded due to 'not qualitative research' ( $n = 6$ ), 'not about policy process' ( $n = 18$ ), 'not national' ( $n = 19$ ), 'media analysis' ( $n = 8$ ), 'studies about public's views' ( $n = 1$ ), 'not a peer reviewed study' ( $n = 1$ ),

'not food' ( $n = 2$ ), 'not about a specific policy or agreement' ( $n = 6$ ) (Figure 14). Thus 30 papers met the inclusion criteria and were included in this synthesis (Table 22).

### Study characteristics

Twenty-four papers studied the policy process of regulatory policies in 19 countries: Brazil, Canada, Colombia, Chile ( $n = 2$ ), Denmark, Fiji ( $n = 3$ ), France, French Polynesia, Hungary, Ireland, Mexico ( $n = 3$ ), Nauru, Samoa ( $n = 2$ ), Saudi Arabia, South Africa ( $n = 2$ ), Thailand, The Philippines, UK ( $n = 2$ ), USA. Three papers reported studies on the policy process of voluntary approaches on salt reduction in Argentina and Fiji, and on restrictions on marketing of unhealthy food to children in Spain.

Three papers reported studies of the policy process of PPPs on Healthy Food Partnership and FHD in Australia, on the Public Health RD in England, and on Healthy Lifestyles school-based PPPs in seven countries: China, India, South Africa, Mexico, Brazil, UK, Germany.

Nine studies reported the policy process of establishing taxes, and among these most ( $n = 7$ ) focused on SSB tax [Saudi Arabia, South Africa, Mexico ( $n = 3$ ), Chile, France, Fiji, Samoa, French Polynesia, Nauru]. Others reported on sugar tax (Ireland) and tax on fats (Denmark). Four countries reported on processes related to nutrition labelling (Chile, Colombia, UK) and specifically of trans-fatty acids (Brazil). Two studies focused on regulation to limit salt intake (Samoa, South Africa). Three studies reported on restrictions on marketing of unhealthy foods to children [Fiji ( $n = 2$ ), The Philippines], two on restrictions on marketing of breastmilk substitutes (Samoa, Thailand), and one on regulation of television food advertising to children (USA). Finally, two studies reported on school food regulation (Hungary, Mexico) and one on mandatory standard for limiting food products and promotions in hospital retail outlets (UK). One study assessed the food and beverage industry influence on a national nutrition policy (Canada). These are summarised in Table 23.

### Quality assessment of included studies

The quality assessment of included studies was done using the ten standardised criteria of the CASP tool (see Table 22). All of the included studies gave a clear statement of the aims of the research, used qualitative methodology appropriately, has an appropriate research design to address the aims of the research, used an appropriate recruitment strategy, collected data in a way that addressed the research issue, analysed the data sufficiently rigorously, and had a clear statement of findings. Nearly all had

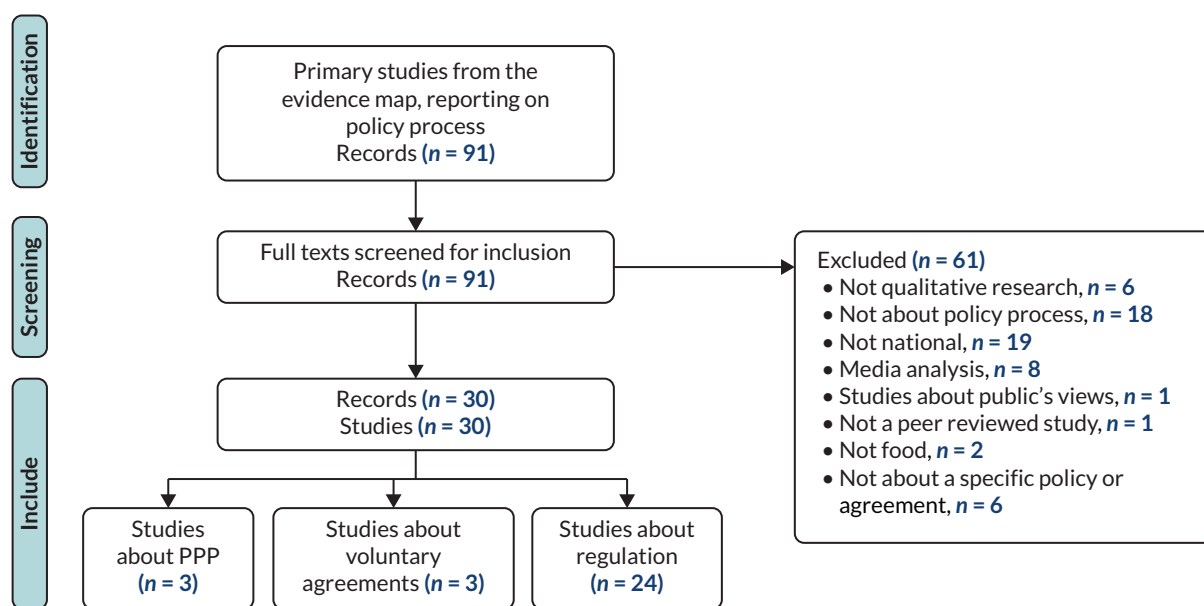


FIGURE 14 PRISMA flow chart representing the selection process for the review of studies on policy process. Adapted from the PRISMA template by Page *et al.* (2021).<sup>16</sup>

TABLE 22 Critical Appraisal Skills Programme checklist (n = 30)

CASP item included studies	1	2	3	4	5	6	7	8	9	10
<b>Voluntary approach</b>										
Castronuovo <i>et al.</i> (2017) <sup>97</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Davo-Blanes <i>et al.</i> (2013) <sup>98</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Webster <i>et al.</i> (2018) <sup>99</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
<b>PPPs</b>										
Brandon <i>et al.</i> (2020) <sup>100</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Durand <i>et al.</i> (2015) <sup>101</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Perez-Escamilla (2018) <sup>102</sup>	Y	Y	Y	Y	Y	N	N	N	Y	Y
<b>Regulation</b>										
Alsukait (2020) <sup>103</sup>	Y	Y	Y	Y	Y	U	U	Y	Y	Y
Campbell (2020) <sup>104</sup>	Y	Y	Y	Y	Y	U	N	Y	Y	Y
Carriedo (2020) <sup>105</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Davies (2017) <sup>106</sup>	Y	Y	Y	Y	Y	U	U	U	Y	Y
Dorlach (2020) <sup>107</sup>	Y	Y	Y	Y	Y	U	N	Y	Y	Y
Fooks (2019) <sup>108</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Fuster (2020) <sup>109</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
James (2020) <sup>110</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Kaldor (2018) <sup>111</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Kiss (2019) <sup>112</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Le Bodo (2019) <sup>113</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Mialon (2020) <sup>114</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Monterrosa (2015)	Y	Y	Y	Y	Y	N	N	Y	Y	Y
Phillips (2019) <sup>115</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Phulkerd (2017) <sup>116</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Razavi (2019) <sup>117</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Reeve (2018) <sup>118</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Shelton (2017) <sup>119</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stead (2020) <sup>117</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Thow (2011) <sup>120</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Thow (2020) <sup>121</sup>	Y	Y	Y	Y	Y	U	Y	Y	Y	Y
Trieu (2018) <sup>122</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vallgarda (2015) <sup>123</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vandenbrink (2020) <sup>124</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

**Notes**

**Question legend:** 1. Was there a clear statement of the aims of the research? 2. Is a qualitative methodology appropriate? 3. Was the research design appropriate to address the aims of the research? 4. Was the recruitment strategy appropriate to the aims of the research? 5. Were the data collected in a way that addressed the research issue? 6. Has the relationship between researcher and participants been adequately considered? 7. Have ethical issues been taken into consideration? 8. Was the data analysis sufficiently rigorous? 9. Is there a clear statement of findings? 10. Is the research valuable?

**Answer legend:** Y = yes, N = no, U = unclear.

TABLE 23 Study characteristics (n = 30)

Item	Country	Name of policy	Study aim	Methods	N participants and characteristics
<b>Voluntary approaches (n = 3)</b>					
Castronuovo (2017) <sup>97</sup> (ID: 52948582)	Argentina	Less Salt, More Life Program	To contribute to the body of literature and research into decisions in the public health sector regarding voluntary initiatives and PPPs in the prevention of NCDs, attempting to understand the policy process of PPPs from the stakeholders' perspectives.	Interviews Documentary analysis	n = 29: experts on the technical and political aspects of sodium reduction (2), decision-makers from Ministries and government agencies (11) food companies (11); food industry associations (5).
Davo-Blanes (2013) <sup>98</sup> (ID: 52950722)	Spain	Restrictions on marketing of unhealthy food to children	To identify Spanish stakeholders' views on the relationship between childhood obesity and the marketing and advertising of food and beverages aimed at children in Spain, as well as on the corresponding of regulations.	Interviews	n = 13 organisations: experts (2), consumer advocates (1), public health advocates (2), food manufacturers (2), advertising advocates (1), government representatives (1).
Webster (2018) <sup>99</sup> (ID: 52959092)	Fiji	FSIA	This paper reports the process evaluation and costing of a national salt reduction intervention in Fiji.	Interviews	Child/family/school advocates (2) and media (1).
<b>PPPs (n = 3)</b>					
Brandon (2020) (ID: 52946240) <sup>100</sup>	Australia	Healthy Food Partnership FHD	To critically analyse trends in the scope of federal nutrition policy actions in Australia between 2007 and 2018.	Interviews Documentary analysis	n = 6 interviews and 10 documents.
Durand (2015) <sup>101</sup> (ID: 52949550)	UK	The Public Health RD	We explored informants' experiences and views about the RD's development, implementation and achievements.	Interviews	n = 44 interviews with 50 interviewees from partner organisations and non-/former partners (12).
Perez-Escamilla (2018) <sup>102</sup> (ID: 52947859)	China, India, South Africa, Mexico, Brazil, UK, Germany	Healthy Lifestyles school-based PPPs	To identify the factors that enabled the successful implementation of school-based PPPs focusing mainly on nutrition and physical activity in seven countries.	Interviews	n = 19 interviews with key programme leaders from each programme documentary analysis, MIF annual country reports and MIF project reports, proceedings from two school-based healthy lifestyle programme evaluation workshops in October 2013 and in May 2016.



Item	Country	Name of policy	Study aim	Methods	N participants and characteristics
<b>Regulatory approaches (n = 24)</b>					
Alsukait (2020) <sup>103</sup> (ID: 52944441)	Saudi Arabia	SSB tax	To add to the global discussion on SSB tax design and policy process by highlighting the Saudi Arabia's barriers and facilitators to implementation.	Interviews Documentary analysis	n = 10 from health agencies (4), non-health agencies (3), industry (3).
Campbell (2020) <sup>104</sup> (ID: 52946177)	Ireland	Sugar tax	We focused the analysis on the food industry actors' response to the proposal to introduce a SSB tax. Specifically, the aim was to explore the use of framing in the industry submissions in this consultation.	Documentary analysis	n = 14 industry actor submissions to the sugar tax consultation.
Carriedo (2020) <sup>105</sup> (ID: 52946148)	Mexico	SSB tax	To examine the political context out of which this policy emerged, the main drivers for the policy change, and the role of stakeholders in setting the policy agenda and shaping the policy design and outcomes.	Interviews Documentary analysis	n = 31 stakeholders from industry (5), academia (7), government (10) civil society (4), international organisations (2), media (3), think tanks (2) 145 documents, including peer reviewed papers, policy briefs, press releases, industry, government and CSO reports.
Davies (2017) <sup>106</sup> (ID: 52969104)	Brazil	Food labelling of trans fatty acids	To identify the stakeholders and to present their opinions about the mandatory trans-fat content during the public consultation carried out prior to the law coming into effect in 2007.	Documentary analysis	n = 25 stakeholders made contributions to the public consultation; 6 from academic and health professional bodies, 2 from other professional bodies, 2 from government departments, 14 from the food industry and 1 from the pharmaceutical industry.
Dorlach (2020) <sup>107</sup> (ID: 52965914)	Chile	Nutrition labelling	To understand how common practices such as public consultation submissions, corporate threat letters, and external legal assistance influence regulators' understanding of their 'legally available' policy space, we study the contested introduction of a pioneering nutrition labelling regulation.	Interviews Documentary analysis	n = 30 interviews with those involved in regulatory conversations over Child's nutrition label, but not food industry representatives. Submissions to consultation on Chile's draft regulation, internal communications between the food industry and foreign states' trade policy agencies about the regulation, and internal reports by the Chilean bureaucracy are key sources for the reconstruction of the interpretive contest over the legality of Chile's nutrition label.

continued

**TABLE 23** Study characteristics (*n* = 30) (continued)

Item	Country	Name of policy	Study aim	Methods	N participants and characteristics
Fooks (2019) <sup>108</sup> (ID: 52947149)	South Africa	SSB tax	To scrutinise industry submissions to the South African government's consultation on a proposed SSB tax and examined their use of evidence.	Documentary analysis	<i>n</i> = Industry submissions to the South African government's consultation on a proposed SSB tax.
Fuster (2020) <sup>109</sup> (ID: 52946727)	Mexico Chile	SSB tax	To examine the policy change process that resulted in the current SSBs taxes in Mexico and Chile.	Interviews	<i>n</i> = 24 including 16 researchers (5 from Mexico, 5 from Chile and 6 Global), 3 food and beverage industry representatives (1 from Mexico, 2 Global) and 5 civil society representatives (3 from Mexico, 2 from Chile).
James (2020) <sup>110</sup> (ID: 52946036)	Mexico	SSB tax	This article explores the politics of passage of the SSB tax in Mexico.	Interviews	<i>n</i> = 17 including NGOs (3), academics (4), political strategists (2), bureaucrats (3), politicians (1), trade associations (2), industry (1), lobbyist (1).
Kaldor (2018) <sup>111</sup> (ID: 52946215)	South Africa	Regulation to limit salt intake	To analyse the policy process for the South African regulation setting upper limits for salt in 13 commonly consumed food categories, to inform future policy action for prevention of NCDs.	Interviews	<i>n</i> = 10 interviews with stakeholders falling into four sectors: government ( <i>n</i> 3), academia ( <i>n</i> 2), the food industry ( <i>n</i> 3) and NGOs ( <i>n</i> 2).
Kiss (2019) <sup>112</sup> (ID: 52947265)	Hungary	School food regulation	To analyse the causes of the failure of the school catering regulation.	Interviews	<i>n</i> = 72 interviews with stakeholders: including 33 experts, 13 teachers and 26 parents.
Le Bodo (2019) <sup>113</sup> (ID: 52944494)	France	SSB tax	To get an insight into policy processes of the soda tax.	Documentary analysis	<i>n</i> = Publicly available legislative documents and scientific articles and grey literature. Inventory of legislative documents, a comprehensive press review, and a purposive sample of scientific articles and grey literature.
Mialon (2020) <sup>114</sup> (ID: 52946439)	Colombia	Nutrition FOPL	To identify and monitor food industry use of political practices during the adoption of nutrition WL in Colombia.	Interviews Documentary analysis	<i>n</i> = 18 key informants from the government ( <i>n</i> 2), academia ( <i>n</i> 1), civil society ( <i>n</i> 12), the media ( <i>n</i> 2) and a former food industry employee ( <i>n</i> 1).

Item	Country	Name of policy	Study aim	Methods	N participants and characteristics
Phillips (2019) <sup>115</sup> (ID: 52946874)	Fiji	Restrictions on marketing of unhealthy foods to children	To examine how neoliberal logic is experienced, internalised and resisted by nutrition policy makers in Fiji.	Interviews	n = 11 semi-structured interviews with nutrition policy makers and stakeholders.
Phulkerd (2017) <sup>116</sup> (ID: 52944684)	Thailand	Restrictions on marketing of breastmilk substitutes	To identify barriers and potential facilitators to the implementation of both the RTA and 25% SFS policies.	Interviews	n = 28 participants holding senior positions in government, industry and civil society organisations.
Razavi (2019) <sup>117</sup> (ID: 52946192)	UK	Nutrition FOPL	To explore one aspect of the decision-making process public consultation on policy proposals by a national regulatory body aiming to understand how public health policy development is influenced by different stakeholders.	Documentary analysis	n = 139 responses from key stakeholder groups in a consultation process on the regulation of television advertising of foods high in fat, salt and sugar aimed at children.
Reeve (2018) <sup>118</sup> (ID: 52947524)	The Philippines	Restrictions on marketing of unhealthy foods to children	To identify barriers and enablers to effective school food policy development and implementation.	Interviews	n = 21 interviews with policy-makers and stakeholders involved in school food policy-making and implementation.
Shelton (2017) <sup>119</sup> (ID: 52948500)	USA	Regulation of television food advertising to children	To understand the key framing approaches used by private industry vs. public health sector, with the goal of informing future public health messaging, framing and advocacy in the context of policy-making.	Documentary analysis	n = 97 consultation documents submitted on behalf of organisations (private industry, n 64; public health, n 33).
Stead (2020) <sup>117</sup> (ID: 52946725)	UK	Mandatory standard for limiting food products and promotions in hospital retail outlets	To examine implementation process and changes to the retail environment in relation to food promotions and choice.	Interviews	n = 32 interviews with the shop manager or nominated members of staff.
Thow (2011) <sup>120</sup> (ID: 52951707)	Fiji, Samoa, French Polynesia, Nauru	SSB tax	To analyse four different soft drink taxes in Pacific countries and documented the lessons learnt regarding the process of policy agenda setting and implementation.	Interviews Documentary analysis	n = 31 stakeholder interviews in Fiji (10), Samoa (11), Nauru (6) and French Polynesia (4). Collected policy documents and reports.

continued

TABLE 23 Study characteristics (n = 30) (continued)

Item	Country	Name of policy	Study aim	Methods	N participants and characteristics
Thow (2020) <sup>121</sup> (ID:52946632)	Fiji	Restrictions on marketing of unhealthy foods to children	To draw lessons from Fiji regarding the challenges and opportunities for policy initiatives to restrict (1) food marketing to children and (2) marketing of breast milk substitutes, to inform policy for the double burden of malnutrition.	Interviews	n = 11 key informants from relevant sectors, representing public health, economic and consumer interests.
Trieu (2018) <sup>122</sup> (ID: 52947906)	Samoa	Restrictions on marketing of breast milk substitutes	To conduct a process evaluation to investigate the reach, dose/adoption, fidelity, cost, and context of MASIMA (Samoa's national, government led salt reduction strategy), including a qualitative evaluation of implementation factors.	Interviews	n = 25 interviews: with 8 Ministry of Health, 7 other government organizations, 6 community leaders, 4 food industry representatives.
Vallgarda (2015) <sup>123</sup> (ID: 52949501)	Denmark	Tax on saturated fat	To present arguments and themes involved in the debates surrounding the introduction and the repeal of the tax on saturated fat.	Interviews Documentary analysis	An analysis of parliamentary debates, expert reports and media coverage; key informant interviews; and a review of studies about the effects of the tax on consumer behaviour.
Vandenbrink (2020) <sup>124</sup> (ID: 52963550)	Canada	Healthy Eating Strategy	To describe the interactions between Health Canada and industry and non-industry stakeholders and to identify the strategies used by industry to influence food and nutrition policy.	Documentary analysis	Documents such as correspondences and presentations exchanged in interactions between Health Canada and stakeholders regarding the Healthy Eating Strategy.

FSIA, Fiji Sodium Impact Assessment Project; MIF, Mondelez International Foundation; RTA, reciprocal translational analysis; WL, warning labels.

taken ethical issues into consideration. Though most studies were rated 'unclear' or 'no' against the question about whether the relationship between researcher and participants has been adequately considered, overall, the final criteria about whether the research is valuable was answered 'yes' for all included studies.

Conflict of interest statements and funding sources were reviewed for all studies and only one was funded by the food industry to review food industry partnership programmes.

### ***Factors reported to shape the food and nutrition policy process***

#### **Reported factors supporting the achievement of the approach to improve diets**

The reviewed studies highlighted supportive factors, including clear government leadership and the commitment of the executive branches in the case of fiscal measures; ensuring that tax contributed both to the government budget and aligns with the health agenda, such as overarching NCD or obesity strategies; the use of international best evidence, and localised health and economic evidence; co-ordination with trade experts for legal support; harnessing focusing events like newly elected governments or government priorities to reduce deficits and address obesity prevention, and communicating clear targets and compliance measures to commercial actors or partners.

The importance of clear leadership on a regulatory decision was evident across the literature, but leadership was manifested in different ways. For example, decisions to go ahead with the SSB tax in Saudi Arabia was attributed to swift decision-making by the Supreme Council, the highest GCC decision-making body.<sup>103</sup> In the case of the SSB tax in Mexico however, Fuster *et al.* (2020) cited the importance of both top-down leadership AND bottom-up pressure from civil society coalitions for policy adoption.<sup>109</sup> They also reported the commitment of executive branches, despite pushback from industry, in helping to argue for the inclusion of SSB taxes as larger fiscal reforms.<sup>109</sup> Thow *et al.* (2011)<sup>120</sup> studied SSB tax implementation in Fiji, Samoa, Nauru and French Polynesia, and concluded that a key to getting SSB taxes on the agenda was contribution of the tax to the government budget, and aligning tax priorities to the health agenda, such as diabetes prevention and control on Nauru.

In Hungary, Kiss *et al.* (2019) reported on a school food reform and cited government leadership as being crucial (even though weak), given that power is centralised and most schools are state owned.<sup>112</sup>

A number of studies highlighted the role of policy entrepreneurs (high-profile individuals who are willing to invest their resources in driving change to address a problem of personal interest) and strategists. For example, in another study of the passage of the SSB tax in Mexico, James *et al.* (2020)<sup>110</sup> reported that financial support provided by Bloomberg Philanthropies allowed the employing of political strategists who brought public awareness and public attention, and helped create public health/pro tax advocacy coalition [James *et al.* (2020)].<sup>110</sup> The importance of the use of localised health and economic evidence was reported by Dorlach *et al.* (2020) who found that two key factors in bringing about nutrition labelling regulation in Chile were experience in nutrition science and co-ordination with Chile's trade policy agency, which had high legal expertise.<sup>107</sup>

Several studies mentioned the importance of harnessing focusing events, such as newly elected governments and related fiscal reforms. In the process of passing the SSB tax in Mexico, Fuster *et al.* explain that this was broadly considered a selected issue rather than an urgent problem, meaning that policy-makers did not see it as priority; this creates more opportunities for other stakeholders such as industry to get involved, and so linking the issue to existing priorities or events was key.<sup>109</sup> In their study of factors influencing the passing of the SSB tax in France, Le Bodo *et al.* (2019) also referred to linking the regulation to other events of importance, for example, the government's priority to reduce deficits in context of economic downturn, to relieve wage costs in the farming sector, and obesity prevention as a long-standing issue.<sup>113</sup>

In the six included studies on the policy process of voluntary approaches or PPPs, the reported enabling factors were much the same as for success in achieving regulation. In the study of decision-making processes that led to the establishment of the Australian Healthy Food Partnership (a PPP between big food industry players and the national government), Brandon *et al.* (2020) also refer to the importance of clear leadership from public sector actors, however they noted that this decision was not informed by a review of international evidence of best practice of voluntary versus regulatory practices.<sup>100</sup> Contextual factors were also of importance, such as the Australian political context and specifically ideological resistance towards regulation.<sup>100</sup> Thus Brandon *et al.* report the role of compromise, for example, the selection of three reformulation nutrient targets (total sugar, saturated fat and salt) to comprise between considerations of feasibility, evidence gaps and food industry receptiveness; and of pragmatism, engaging with industry to ensure policy success, harness resources and expertise of industry.<sup>100</sup>

Castronuovo (2017)<sup>97</sup> report on a voluntary approach to reduce salt in Argentina, initiated by the Ministry of Health but with the food industry playing a leading role in the policy process, and was eventually important in the transition to a sodium reduction law. The authors explain that this was largely due to health being kept a priority on the public agenda and facilitated because the targets had already been negotiated with the private sector. In their study of mandatory standards for making hospital retail outlets healthier in Scotland, Stead *et al.* (2020)<sup>117</sup> also cited centralised processes for sourcing products and training.

In the only study funded by industry (Mondelez International Foundation), Perez-Escamilla (2018)<sup>102</sup> reviewed the key factors that enabled the successful implementation of a series of school-based PPPs focusing on nutrition and physical activity, funded by the Mondelez International Foundation. The lessons for success cited the importance of equal representation from partners on committees, clarity and openness of decision-making processes, equal decision-making authority, all of which support transparent monitoring and evaluation. Yet we caution that these findings should be considered in light of the other independently funded results reported here, which point to the limited effectiveness of PPPs and voluntary approaches (see [Chapter 5](#) and [6](#)); the success factors cited by Perez-Escamilla are refuted in several evaluations of PPPs, such as in the Public Health RD a PPP in England (2011–5), where giving industry leadership roles in a public health policy led to watering down of pledges and partnership aims, and ultimately limited impact of the PPP overall. In analysing the drivers of the participation in Public Health RD, Durand *et al.* (2015)<sup>101</sup> find that key motivations of corporate participation included reputation enhancement and meeting corporate social responsibility targets.

### **Reported factors impeding the achievement of an approach to improve diet**

The reviewed studies on policy process of regulations highlighted a range of impeding factors: lack of government will or leadership, poor governance mechanisms to implement the policy, lack of community support and engagement of the public; lack of recognition of conflicts of interest when government is too close to industry interests; the deployment of industry strategies such as legal threats, lobbying decision-makers, engaging high-ranking public officials, challenging the evidence, challenging the benefits of regulation and promoting voluntary approaches, encouraging narratives of personal responsibility, and positioning themselves as important legitimate role models.

Several studies analysed the process of implementing a SSB or sugar tax, most of whom including Le Bodo (2019)<sup>113</sup> (France) and Fuster (2020)<sup>109</sup> (Chile and Mexico) mentioned the strong opposition of the food and beverages industry to SSB taxation, which was also reflected in the deployment of arguments such as the benefits of voluntary self-regulation, the negative impact of a tax on the economy, and the unfairness of a tax on industry and on individuals. This was reflected in Fooks' (2019) analysis of industry submissions in the lead up to the SSB tax process in South Africa, deploying arguments that the policy would have wide ranging adverse social and economic consequences.<sup>108</sup>

In Thow *et al.*'s (2011)<sup>120</sup> study of SSB tax implementation in Fiji, Samoa, Nauru and French Polynesia, industry pressures, as elsewhere, had an impact and in Fiji, organised industry opposition to the tax

resulted in its removal. Phillips' *et al.* (2019)<sup>115</sup> more recent study of nutrition policy-making in Fiji reports how efforts at restricting marketing of unhealthy foods to children and of breast milk substitutes were also overturned due to obstructive industry interests, and a narrative of personal choice and responsibility that dominated consumer decisions.

Campbell *et al.* (2020)<sup>104</sup> conducted an analysis of how frames are generated through the case of the sugar tax in Ireland and present a sophisticated typology of framing mechanisms. One such mechanism is the act of dichotomising, or the division of frames into binary blocs, for example, weaponising the opponent's logic: as the authors note, a common example is claiming a lack of causal evidence for sugar tax efficacy. This strategy is illustrated in Fooks *et al.* (2019) policy analysis of the SSB tax in South Africa, where industry actors opposing the tax were reported to use confounding references (misleading use of references which either overstates or gives an entirely false impression of support for a claim or obstructs evidence appraisal), and 'evidential landscaping' (promoting alternative evidence, or purposefully excluding relevant evidence), more broadly referred to as agnogenic practices, or methods of representing, communicating and producing scientific research and evidence, which work to create ignorance or doubt irrespective of the strength of the underlying evidence.<sup>108</sup> It is also echoed in Vandenbrink *et al.* (2020)<sup>124</sup> in their study of the food and beverage industry's influence on a national nutrition policy (the Healthy Eating Strategy) in Canada, where industry regularly challenged the evidence underpinning regulation and employed the arguments that regulation would lead to detrimental impacts on the economy.

Campbell *et al.* (2020)<sup>104</sup> also suggest 'contesting' as a framing mechanism, referring to shaking the frame so that arguments are used by different stakeholders; an example of contesting as a framing strategy is reported in Le Bodo *et al.* (2019) where during the SSB tax process in France, the food industry firmly and publicly opposed the tax, but then became open to contribute to resolving the public deficit, provided the tax rationale is not public health oriented, positioning themselves as concerned role models within the community.<sup>113</sup>

Other papers reported factors such as lack of consumer engagement, as reported in a study by Kiss *et al.* in on factors shaping the school catering system in Hungary, where 'nutrition illiteracy' of teachers and students was not taken into consideration, leading to lack of engagement of these key stakeholders.<sup>112</sup> Similarly in Denmark, Vallgarda *et al.* (2015)<sup>123</sup> report that lack of policy engagement and strong proponents, but many influential opponents, to the saturated fat tax, led to its demise.

Several studies reported on the process of implementing FOPL: Razavi (2019)<sup>117</sup> analysed an early consultation process and cited similar barriers, where the final policy appeared to be substantially influenced by stakeholders. Mialon (2020)<sup>114</sup> studied the FOPL process in Colombia and cited hindering factors such as the industry deployment of legal threats, lobbying Congress, engaging high-ranging public officials. Mialon and colleagues report that unlike other countries, in Colombia, food industry actors and government officials have openly close ties, and so the industry sponsoring of congresses at universities was considered unconflicted behaviour, though the authors conclude that these actions may have worked to weaken the FOPL policy. Competing ideologies and the 'market-centric' logic of government decision-making were also cited as factors, which negatively affected restrictions on marketing of unhealthy foods to children in Fiji as reported by Phillips (2019)<sup>115</sup> who also (like Kiss *et al.* above) cited lack of community support and inadequate healthy literacy. In Vandenbrink *et al.*'s (2020)<sup>124</sup> study of the food and beverage industry's influence on a national nutrition policy (the Healthy Eating Strategy) in Canada, another reported industry strategy was policy substitution or promoting alternatives to regulation such as voluntary codes and self-regulation.

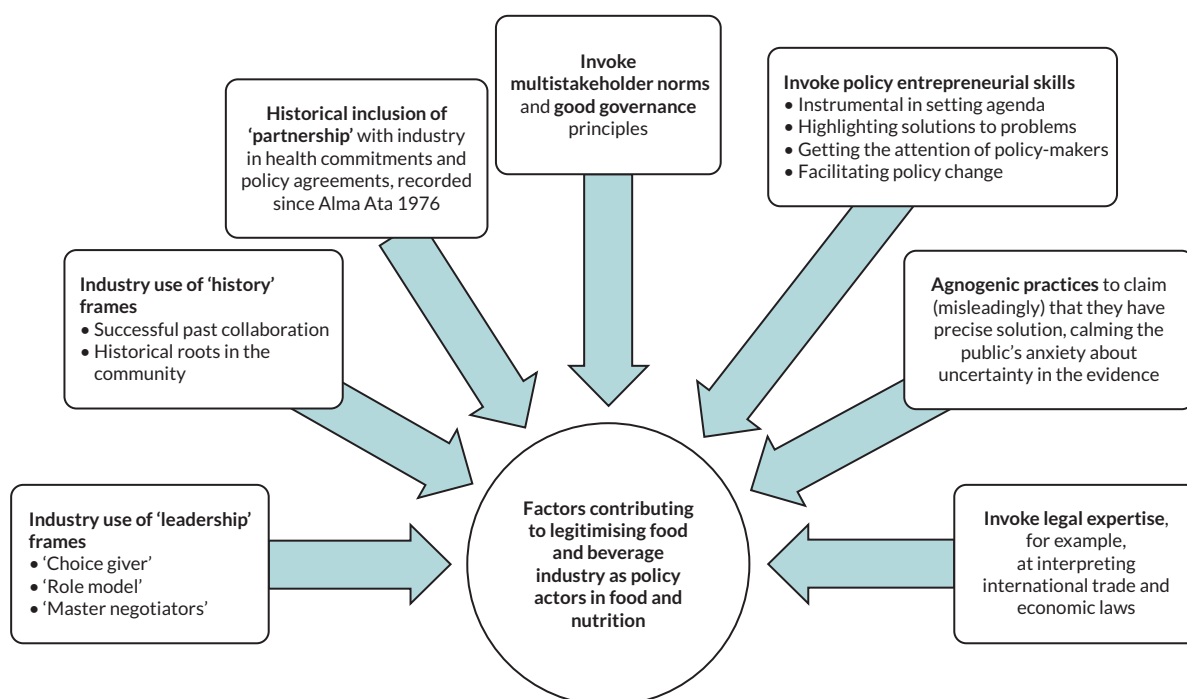
Webster *et al.* (2018)<sup>99</sup> report a national salt reduction intervention in Fiji, including voluntary engagement of the food industry to adhere to salt reduction targets, which had been evaluated to have limited effect. Webster *et al.* (2018) report that the strategy to engage industry actors was unclear, with no compliance mechanisms in place; moreover, governance mechanisms of the salt reduction intervention could have been optimised, with stronger government leadership. In their study of school

food policies and marketing restrictions in the Philippines, Reeve (2018)<sup>118</sup> also reported the role of insufficient human and financial resources for implementation as well as policy enforcement; moreover the food industry actors harnessed existing relationships with schools to promote their brand and challenge the establishment of more robust school food policies. In their study of mandatory standards for making hospital retail outlets healthier in Scotland, Stead *et al.* (2020)<sup>117</sup> also cited the need for more policy implementation guidance and support.

**Legitimacy of commercial actors as policy actors**

The dominant place of the food and beverage industry across nearly all reviewed policy process studies raises the question of what legitimacy they have in designing and implementing public health policies. These studies provide insight into these phenomena and mechanisms underpinning the policy process for improving diet, in particular how large food and beverage industries have established a relatively secure position in policy interventions to improve diets. As demonstrated in the reviewed studies, when commercial actors are able to dominate the narrative and set the agenda of public discourse, they acquire a disproportionately high ability to ‘define’ a public process and thus gain legitimacy,<sup>125</sup> defined as a measure of the level of trust and confidence an institution should command.<sup>125</sup>

Figure 15 summarises key mechanisms of interest as emerging from the literature. Brandon *et al.* (2020) discuss the food industry’s use of ‘leadership’ frames such as ‘choice giver’, ‘role model’, ‘master negotiators’.<sup>100</sup> For example, the authors provide the example of industry actors negotiating in a politically supportive environment (Australian government was not keen on regulation): industry actors not only negotiated but imposed an underlying assumption that pragmatism and compromise are fundamental to achieving food policy, at the expense of the best evidence.<sup>100</sup> Campbell *et al.* (2020)<sup>104</sup> further explain that ‘corporate actors assume the role of the “choice giver”, while the dichotomized alternative is government, which is forced to occupy the opposing domain in the frame as the infantilizing remover of choice’<sup>104</sup> This is relevant to understanding the legitimisation of industry as leaders in food/nutrition, as they ‘assume the role of the choice giver’ – this is a positive, confident act, one which demonstrates or even takes without asking the role of making a decision about what a consumer should do or not.



**FIGURE 15** Emerging higher understanding of the accepted legitimacy of food industry as global leaders.



Campbell *et al.* (2020)<sup>104</sup> refer to the framing strategy of equating-equalising of logics, to level all audience; for example, emphasising 'progress' made on voluntary codes and positioning themselves as 'industry leaders'; demanding a seat at the policy-making table, appealing to historical roots and reminding how they are firmly established in the fabric of society.<sup>104</sup> Campbell *et al.* (2020)<sup>104</sup> also report how the food industry will present itself as fully committed to health problems, positioning themselves as concerned role models within the community, which contribute to supporting the establishment of their legitimacy as leaders.<sup>104</sup>

Fuster *et al.* (2020) report that in Chile and Mexico the food and drinks industry carried out a failed legal challenge to the SSB tax constitutionality, while also appealing to the public, by positioning themselves as defenders of consumer freedom; this contributes to building an image of the industry as champions of consumer rights. Finally, Mialon (2020)<sup>114</sup> report the use of key platforms such as Codex used by the industry to gain access to decision-making, in the case of FOPL in Colombia.

## Conclusions

We reviewed 30 studies of the policy process of regulatory, voluntary and PPPs approaches. A range of useful lessons from these studies are reported, both on facilitators and barriers. What emerges strongly is the dominant role of the food industry as often the major reason for the derailing of policies, yet (or perhaps because of) with a very central decision-making or at least influencing position in the policy process. Thus, from the available evidence reviewed, we have advanced our understanding of phenomena and mechanisms underpinning the policy process for improving diet, in particular how large food and beverage industries have become legitimate actors in policy interventions to improve diets. Mechanisms of interest that emerged from the literature about voluntary and PPP approaches include the industry's deployment of leadership frames ('master negotiators'), of 'history' frames to emphasise historical roots in community, and the promotion of partnership as a preferred policy construct.

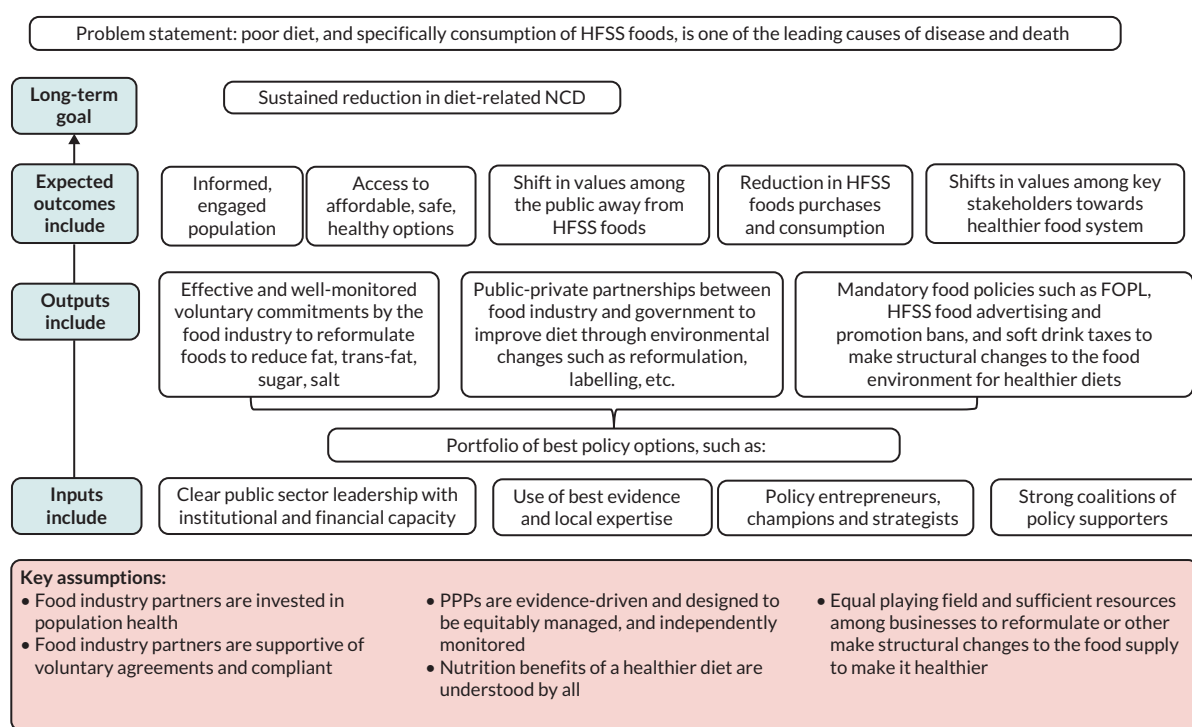


## Chapter 9 Discussion and conclusions

Policy interventions (whether voluntary and/or regulatory) to change the food environment to the population are generally designed to reduce access to and consumption of unhealthy foods, or to change public attitudes and social norms to discourage the purchase and consumption of such foods, ultimately leading to reductions in diet-related diseases. This theory of change, depicted in [Figure 16](#), is at the core of most national strategies to improve diet. The evidence synthesis tested that theory of change by analysing the evidence of effectiveness, cost-effectiveness and policy processes of policy interventions to improve diet, focusing on regulatory, voluntary and partnerships approaches.

### Main findings

We first developed a systematic map of 483 included studies (see [Chapter 3](#)) in order to obtain a comprehensive picture of what policies have been evaluated and how. The map revealed considerable imbalances across the literature, suggesting that policy evaluations are conducted and published inequitably across the world both in terms of quantity and quality. Although 70 countries were represented in the reviewed literature overall, 81% of publications focused on only 12 countries (USA, UK, Australia, Canada, Mexico, Brazil, Chile, France, Spain, Denmark, New Zealand and South Africa), and 30% included the USA. By contrast, 32 countries were only documented in one or two publications each, several of which were multicountry analyses and thus were documented in fewer details. Few publications were found about Africa, Central and South Asia and the Middle East. Reasons for the lack of evaluations (or lack of published evaluations accessible in English-language databases) more broadly across the world are likely to include factors such as funding challenges and language barriers. Inequities were also detected in the study designs for evaluating real-world policies, with the most quantitative robust methods mainly documenting the abovementioned 12 dominant countries. Furthermore, using a generous interpretation of the PROGRESS-Plus equity dimensions, we found that not only 50% of publications assessing policy effectiveness did not compare outcomes by any equity domain, but that



**FIGURE 16** Theory of change of policy interventions to improve the food environment for better diets.

the proportion of those doing so has decreased over time. Age, education (mainly school characteristics) and SES at individual level were the most frequently assessed dimension, while occupation at individual level, religion and culture, social capital and disability were barely considered.

We then assessed the effectiveness and cost-effectiveness of policies to improve diet across four separate systematic reviews.

First, an overview of 11 systematic reviews (see [Chapter 4](#)), with 3 additional reviews for investigating health equity, primarily assessed regulatory policies (especially taxation) and a small number of voluntary approaches by the public sector, food retailers and restaurant chains. Except for salt and saturated-fat-related taxes, for which evidence is limited to few real-world initiatives including some with particularly narrow scopes, most regulatory approaches designed to improve health, consumer behaviour (e.g. food intake, purchases), and food environment outcomes appear to be effective. Effects for voluntary approaches by public and private actors were also generally positive for salt and trans-fat reformulation (but regulatory trans-fat bans were more promising), labelling on products and supermarket shelves, and changing defaults in children's menus in restaurants, although some of them relied on single cross-sectional studies in the USA. Results for voluntary menu labelling and multicomponent commitments by large retail chains were mixed. The findings by PROGRESS-Plus categories indicate a lack of reporting of outcomes in systematic reviews for specific population groups: overall, evidence on specific population groups is patchy, incomplete, mainly inconsistent, and largely relies on single studies (although some evaluations had large samples) rather than aggregated bodies of evidence.

Second, we reviewed the effectiveness of PPPs (see [Chapter 5](#)). From the available evidence reviewed across 17 studies evaluating 7 PPPs, it would appear that partnerships with the food industry to improve diets via reformulation or other changes to the environment have limited effectiveness at improving population diets and food environments.

Third, we reviewed the effectiveness of voluntary approaches by private actors (see [Chapter 6](#)). Sixteen studies of nine voluntary approaches by private actors mainly focused on advertising and marketing control, reformulation, and the retail and catering sectors. From the available evidence reviewed, when comparing effectiveness among participants in voluntary commitments to NPs, the direction of effect or of association for most outcomes appeared to be either inconclusive or worse for participants. Thus from the available evidence reviewed, it would appear that policies designed as voluntary approaches led by commercial actors are not an effective approach at reducing advertising or other promotion of unhealthy products to children, improving the nutritional composition of food and beverages, encouraging calorie menu labelling in chain restaurants, or reducing marketing content targeting children on food packages.

Fourth, we assessed the cost-effectiveness of real-world policies to promote healthy diets (see [Chapter 7](#)). Two studies suggested positive impacts for the fiscal measure of the Mexican SSB tax, and one for the voluntary government-led HSR FOPL intervention in Australia. The fourth one showed a lack of effectiveness and cost-benefit for the PPP intervention to reduce salt consumption in England as part of the Public Health RD. There is a pressing need to build on the extensive literature on the effectiveness of interventions with high-quality evidence on cost-effectiveness, to support meaningful action to tackle the scourge of diet-related ill health.

Our final study set out to assess what factors affect the process of national policies (see [Chapter 8](#)), from choice of policy design to implementation. The 30 included studies revealed key enabling factors, including the reviewed studies highlighted supportive factors, including clear government leadership and the commitment of the executive branches in the case of fiscal measures; ensuring that tax contributed both to the government budget and aligns with the health agenda, such as overarching NCD or obesity strategies; the use of international best evidence, and localised health and economic

evidence; co-ordination with trade experts for legal support; harnessing focusing events like newly elected governments or government priorities to reduce deficits and address obesity prevention, and communicating clear targets and compliance measures to commercial actors or partners. The reviewed studies on policy process also highlighted a range of impeding factors: lack of government will or leadership, poor governance mechanisms to implement the policy, lack of community support and engagement of the public; lack of recognition of conflicts of interest when government is too close to industry interests; the deployment of industry strategies such as legal threats, lobbying decision-makers, engaging high-ranking public officials, challenging the evidence, challenging the benefits of regulation and promoting voluntary approaches, encouraging narratives of personal responsibility, and positioning themselves as important legitimate role models.

This review also advanced our understanding of phenomena and mechanisms underpinning the policy process for improving diet, in particular how large food and beverage industries have become legitimate actors in policy interventions to improve diets. Mechanisms of interest that emerged from the literature about voluntary and PPP approaches include the industry's deployment of leadership frames ('master negotiators'), of 'history' frames to emphasise historical roots in community, and the promotion of partnership as a preferred policy construct despite its ineffectiveness.

Though we were also interested in reporting any unanticipated effects of evaluated policies, it became clear during the review of included studies that these outcomes were not explicitly reported, thus requiring further investigation.

## **Implications for public health policy to improve food environments and population diets**

This study highlights five main public health policy implications to improve food environments at the global level and specifically for England.

### ***Structural changes through regulation appears the most effective approach to improve the food environment***

A first implication relates to the finding that from the available evidence reviewed, policies appear most effective when targeting the structural rather than informational level and made mandatory. The findings align in large part with key existing recommendations for effective and cost-effective approaches including, notably the WHO Best Buys (2017),<sup>126</sup> which advise to reduce salt intake via the reformulation of food products, eliminate industrial trans-fats by banning their use in the food chain, replace trans and saturated fats with unsaturated fats, and reduce sugar consumption through effective taxation on SSB. It also suggests that countries work to reduce portion and package size and implement FOPL. As reported by Francesco Branca, the WHO direction of Nutrition for Health and Development, in his 2019 BMJ article,<sup>127</sup> a large proportion of countries have not implemented evidence-based 'structural actions' to effectively improve food environments, including implementing a ban on industrially produced trans-fats, taxing SSBs and unhealthy foods, and mandating simplified, interpretive FOP nutrition labelling.

In England, much of the government's response to unhealthy diets has focused on obesity prevention and reduction.<sup>128</sup> The 2016 Childhood Obesity Plan proposed a set of actions, including the introduction of a SDIL; the reduction by 20% of sugar in products that contribute most to intakes of children up to 18 years by 2020; the reduction of calories in a range of products contributing to children's intakes; reducing salt in products by achieving the 2017 salt targets; providing clearer food labelling; making healthy options available in the public sector; making school meals healthier; and developing a new framework by updating the Nutrient Profile Model. In 2020, the plan 'Tackling obesity: empowering adults and children to live healthier lives'<sup>129</sup> mentioned the need for mandating calorie menu labelling in large out-of-home food caterers; for using legislation to control volume promotions of HFSS foods, for

example buy one get one free, as well as their placement in locations that trigger unintended purchases, in retail settings that sell food and drink both in-store and online in England; and for both expanding the ban of advertising of foods HFSS on TV and exploring options online.

Many of these have been rolled out. For instance, the SDIL came into force in April 2018, imposing a two-tiered levy on manufacturers of soft drinks who did not reduce the amount of sugar in their beverages to below one of two stated levels,<sup>130</sup> aiming to reduce NCDs associated with excess sugar consumption.<sup>131</sup> The SDIL has led some of the soft drinks industry to reformulate products to below one or both of the thresholds.<sup>132,133</sup> Early estimates suggest that the SDIL will contribute to improving health and decreasing health inequalities.<sup>134,135</sup> The regulations restricting promotions of HFSS products by location and price were due to come into force in October 2022. Those on advertising less healthy products on TV before 9 p.m. and online are expected to be introduced in 2023, pending Parliamentary procedure.<sup>136</sup>

### ***Voluntary approaches and public-private partnerships appear not to be the most effective approach to improve the food environment***

A second implication for public health policy relates to the finding that from the available evidence reviewed, voluntary approaches and PPPs do not appear to be effective at improving food environments for healthier diets. The findings align with earlier studies<sup>14,137-140</sup> and can be explained by the understanding of the functioning of voluntary approaches and PPPs (both from the review and past studies), namely that, commitments or pledges tend not to be based on most effective interventions to improve diets; there is usually a major focus on education and information/behaviour modification rather than on structural (and more effective) changes; self-designed commitments are narrow, vague or loosely binding – not ‘SMART’; voluntary participation of companies in self-regulation schemes is often itself voluntary, which results in an unequal playing field (and even so, some studies included in [Chapter 6](#) found that their outcomes were worse than that of NPs); reporting and monitoring of implementation is often poor; there is limited added value of signing up/pledging apart from promoting a positive corporate image; partners often commit to actions already undertaken; and failure to comply with pledges is not well enforced or penalised.

In England, voluntary approaches are part of the strategy to improve diets. Current initiatives as described below would benefit from taking on board the lessons from the study if we are meaningfully and sustainably to improve food environments for healthier diets.

Public Health England – the government’s public health arms’ length body in existence at the time – was commissioned by the Department of Health to work on sugar reduction in light of a Scientific Advisory Committee on Nutrition report.<sup>134</sup> Their role of encouraging industry compliance to reduce sugar and salt content through regulation and with voluntary approaches reported modest progress across a range of food categories and sectors.<sup>141</sup> The Prevention Green Paper (2019) made further commitments to reduce the population’s salt intakes by publishing revised salt reduction targets in 2020 for industry, to be achieved by mid-2023, ‘keeping all options open if a voluntary approach does not demonstrate enough progress by 2024.’<sup>142</sup>

Currently, the regulation of online advertising of HFSS products is self-regulatory through the Advertising Standards Agency,<sup>143</sup> and as such industry possesses extensive rule-setting power within the regulatory process. A proposal for the total online advertising ban policy proposed as part of the Government’s new approach to address high rates of obesity in the UK included the UK Government pledge to hold a consultation on the total online advertising ban policy, primarily aimed at protecting children from such advertising, which closed on 22 December 2020. The results of the consultation are yet to be announced, and the proposed ban may not be implemented.<sup>144</sup>

### ***Expanding geographical representation of the evidence***

A third implication for public health policy is the need to redress the imbalance in policy evaluation evidence across regions of the world, with this study’s stark finding that 81% of mapped publications

(see [Chapter 3](#)) focused on only 12 countries (USA, UK, Australia, Canada, Mexico, Brazil, Chile, France, Spain, Denmark, New Zealand and South Africa), and 30% on the USA. To the best of our knowledge, there are no evaluations for several countries that have implemented such policies. For example, we are aware that in the Caribbean, Dominica has introduced an excise tax on food and drinks with a high sugar content in 2015. In the Middle East, Iran banned soft drinks broadcast advertising in 2004 and has a salt reduction strategy. In South Asia, Sri Lanka introduced regulatory traffic lights labelling in 2016. In North Africa, Morocco implemented a SSB tax in 2019, revoked it, and reintroduced it in 2020. In Sub-Saharan Africa, soft drinks and unhealthy snacks have been banned in schools in Mauritius since 2009.<sup>145,146</sup> Addressing these gaps will require examining the reasons for the lack of all types of evaluations (or published evaluations) in countries which clearly have implemented policies promoting healthy food environments, and ensuring that future policy analyses capture an equitable geographical spread. Solutions are likely to include increasing both research and publication capacity in the least documented world regions as well as in many other countries. This might also involve setting up cohorts and monitoring systems and should aim at including cost-effectiveness studies within policy evaluations more consistently. Evidence syntheses should also analyse findings from real-world evaluations separately from those of modelling studies, and where appropriate retrieve evidence from all regions of the world.

Understanding the barriers to policy evaluation is essential, and in particular clarifying whether it is a lack of resources, or a lack of contextual evidence to ensure appropriate measures for the local geographical context. Isaranuwatthai *et al.* 2020 assessed the WHO's list of best buy interventions and concluded that best buys evaluated in one setting may not be cost-effective in others, further highlighting the importance of the finding that the available evidence is not globally representative.<sup>147</sup> Isaranuwatthai *et al.* 2020 emphasise that low- and middle-income countries (LMICs) have greater pressures to identify and prioritise more cost-effective and equitable NCD interventions, in the face of even more limited resources.<sup>147</sup>

### **Capturing dimensions of health equity as policy outcomes**

A fourth implication for public health policy relates to the low priority accorded to health equity as a policy outcome. This is despite the measurement and evaluation of equity having been prioritised as a key principle of action by the Commission on Social Determinants of Health of the WHO in 2008,<sup>148</sup> and employing a quite generous interpretation of the PROGRESS-Plus framework. While age, SES at individual level, and education are relatively commonly considered, the remaining dimensions are much more neglected, especially disability, religion and culture, and occupation at individual level, leaving some population groups largely ignored. Social capital was also seldom assessed but we recognise that it is more challenging to operationalise and capture. Some of the dimensions mentioned above can also be difficult to apply in studies of environmental features. However, the evidence map shows that it is possible to consider at least some of them. Guidance with specific examples for different types of 'participants' or measurement units might help promote this practice further. Funders and journal editors could require researchers more systematically to integrate an equity focus on projects beyond the description of study participants' characteristics, and with a particular emphasis on the neglected dimensions where possible. In the overview of reviews, none of the findings on equity considered the epidemiology of diseases to assess impact on health outcomes or whether the gap between groups had reduced or increased through time. Where possible, considering these would help to fill the gap.

### **Need for a systems approach across policies to improve food environments**

A systems approach is a way of conceptualising and thinking through a problem. It can lead to a practical illustration of the complexity of pathways of impact, how different factors can interact, leverage points for change, which may not appear in linear logic models or traditional theories of change, and potential unintended consequences of an intervention.<sup>149</sup> Ideally a systemic theory of change helps to identify the wider drivers of unhealthy diet and prompts a strategy that effectively integrates the identified leverage points.<sup>149</sup>

Unhealthy diets, and diet-related outcomes, are complex, challenging to tackle and seemingly intractable problems requiring an approach that fully engages with and responds to their complexity. However, part of the challenge in finding effective actions is that solutions are conceptualised and planned using traditional theories of change<sup>150</sup> rather than using a systems approach. Most theories of change, as illustrated in [Figure 16](#), suffer from pitfalls, including linear thinking, simple chains of cause and effect, and relying on a fixed plan.

As demonstrated across the research, the approach outlined in the theory of change (see [Figure 16](#)) only partially works. This is because it rests on a series of important assumptions, including that food industry actors are invested in population health; food industry actors are supportive of voluntary agreements and compliant; PPPs are evidence-driven and designed to be equitably managed, and independently monitored.

### Conclusions

The study contributes to the growing field of research on the commercial determinants of health, defined as adverse health impacts attributable to commercial activities and corporate political strategies employed by unhealthy commodity industries to promote products, which can damage health.<sup>151-153</sup> The food and drinks industry employ a range of non-marketing strategies to promote the sale and consumption of their products, including shaping scientific evidence, building constituencies beyond their core business, using litigation, lobbying of decision-makers, and publicly criticising policy process, in the interest of protecting markets. These strategies have been known to increase the chance of 'regulatory chill' – delays, weakening, or abandonment of planned policies<sup>154</sup> – and are manifested in various ways including a dampening effect on specific measures once government is aware of an existing threat to regulation;<sup>155</sup> the abandonment or weakening of proposed regulation to avoid future disputes based around past challenges to similar regulation; and the deliberate instilling of apprehension in other countries trying to implement similar regulation ('cross-border chill').<sup>155</sup>

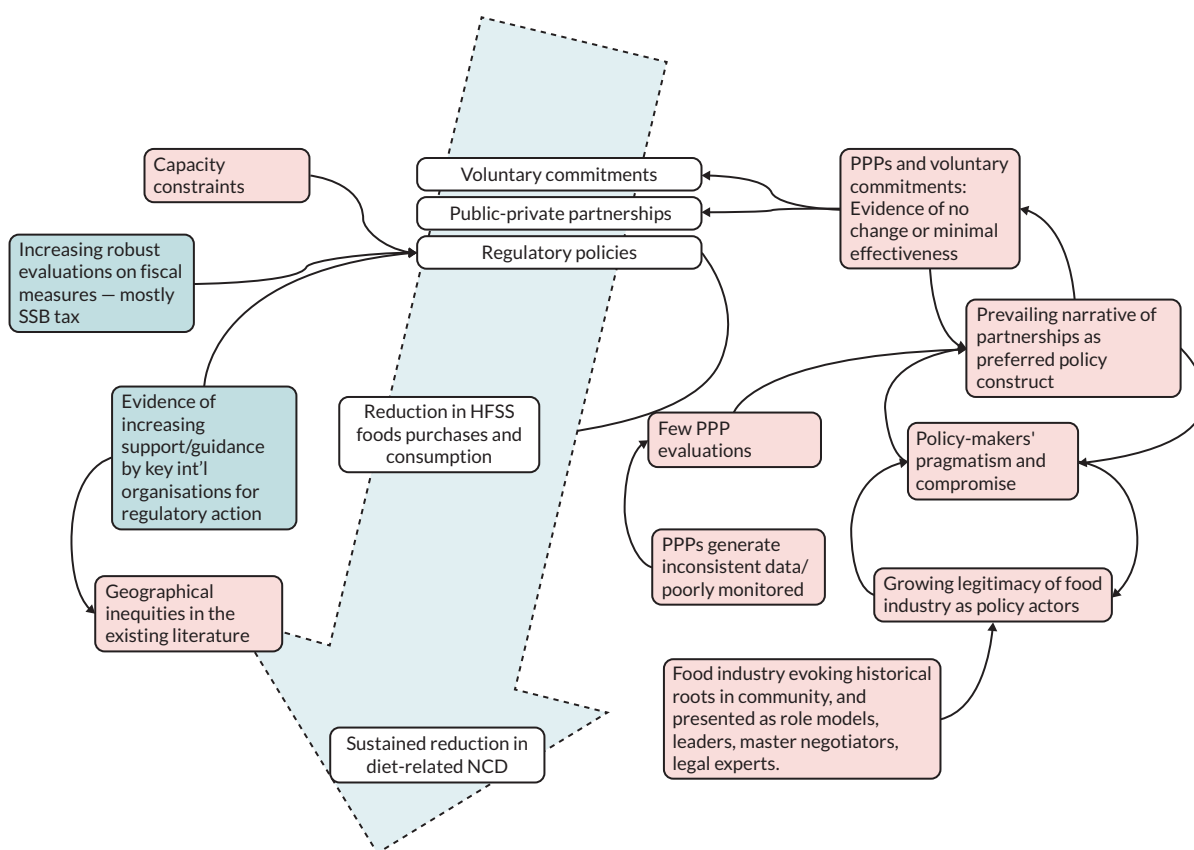
This study has addressed another corporate political strategy, policy substitution, referring to the industry promotion of voluntary and partnership approaches. [Chapters 5](#) and [6](#) indicate quite clearly that these are not the most effective approaches to improve the food environment, and the policy process study (see [Chapter 8](#)) finds that the concept of partnerships as a preferred policy construct is often presented as the most effective to meet public health objectives; however this argument is reported to be seldom informed by a review of international evidence of best practice in supporting healthy diets, but rather compromise and pragmatism. In fact, the evidence map (see [Chapter 3](#)) suggests that few PPPs for promoting healthy food environment have been assessed, and that most of the evidence available is about two PPPs, one in England and one in Australia.

The main proposition of this work, based on the extensive evidence synthesis, is that an improvement of diets in England requires a complex system approach to maximise the potential of a strong portfolio of food and nutrition policies by understanding the more complex drivers and competing interests.

[Figure 17](#) exemplifies this by illustrating some of the factors highlighted by the study that could both dampen and enable the effectiveness of a portfolio of policy interventions, and taking a systems approach can provide an initial illustration of how these important factors interconnect and influence each other.

The evidence synthesis in [Chapter 8](#) highlighted factors working against the above theory of change, including practical considerations often around policy implementation and the generation of context-specific evidence; differing ideological positions; capacity constraints; the role of evidence; lack of key stakeholder engagement, and the deployment by the food and beverage industry of frames and framing strategies to ultimately oppose a policy process. It also highlighted mechanisms underpinning the policy process for improving diet, in particular how large food and beverage industries have become legitimate actors in policy interventions to improve diets, such as the industry's deployment of leadership frames





**FIGURE 17** An illustration of how this evidence synthesis challenges the current theory of change.

(‘master negotiators’), of ‘history’ frames to emphasise historical roots in community, the promotion of partnership as a preferred policy construct, and the use of policy entrepreneurial skills.

Drawing on qualitative system mapping methods and on past work expressing mixed data as system illustrations (e.g. systems evaluations of PPPs;<sup>156</sup> and the formulation of concrete methodological implications of a complexity perspective when conducting systematic reviews and guideline development<sup>157</sup>) we revisit the theory of change, visually adding findings of the evidence synthesis to illustrate the wider picture. Thus [Figure 17](#) displays certain factors of the wider system, as emerging from the findings, and how they work together to either improve (in blue), or reinforce (in red), unhealthy diets in England.

As noted above, the theory of change outlined in [Figure 17](#) rests on the assumptions that food industry actors can participate in, and are supportive of, voluntary agreements to reformulate their products to make them healthier, and that they are able and willing to respond to regulations to make their products healthier or behave in the interest of public health.

## Implications for future policy evaluation methods

### *Need for guidance on appraising risk of bias and quality of non-clinical studies*

Regarding study designs and quality or risk-of-bias appraisals, the systematic review on PPPs (see [Chapter 5](#)) has highlighted the lack of employment of comparison groups. The aggregation of data for participants and NPs in PPPs together suggests that identifying a comparison group can be possible in several cases. Furthermore, in both the latter systematic review and that on voluntary commitments by private actors (see [Chapter 6](#)), we noted a lack of reporting of information that is essential for appraising

study quality or risk of bias, including information on non-responders, the presence of missing data and how it was dealt with, and the number of people collecting or verifying data independently. Similar observations were noted in most systematic reviews, with data on before and after the intervention, effect sizes and precision estimates often missing. Such information should be reported systematically and highlighted when missing in the primary studies. There are already checklists guiding study authors to do so in both primary studies and evidence syntheses. Wider systemic changes in academia with meaningful incentives might be needed to encourage reviewers to examine these attributes more systematically. Moreover, this project highlights the need to revisit the notion of lack of implementation as a source of bias from a policy analysis perspective. Lack of implementation for a policy is not necessarily or simply a bias; it may also be an outcome. It could be a mistake or might have been deliberately planned not to happen. For example, the systematic reviews on the effectiveness of PPPs and voluntary approaches by private actors (see [Chapters 5](#) and [6](#)) found that companies participating in PPPs or pledges continued to advertise, promote or offer unhealthy foods, including to children. The policy document analyses in the review of PPPs also suggest that some of the policies had very low ambitions, included loopholes, or were not monitored by the companies themselves, suggesting that they were more likely to be intended to promote a 'health halo'<sup>75</sup> and a favourable corporate image than to improve population diet.

Furthermore, this project highlights a need for guidance for appraising the risk of bias or study quality of studies measuring the effects of interventions on environments (rather than effects on human) and for critical appraisal of document analyses (including policy and media sources). These types of studies represent 57% of effectiveness studies in the systematic evidence map (see [Chapter 3](#)).

Lastly, as explained in [Chapter 2](#), a wider discussion is needed about the suitability of the GRADE framework for assessing certainty in the evidence of policy research. It should consider the feasibility of different types of studies, recognise the contribution of document and media analyses, and differentiate more effectively the level of certainty between good and weak observational studies. This is aligned with concerns raised by Boon *et al.* (2021)<sup>158</sup> for some public health topics: they have noted the presence of 'discordant recommendations' in which methodologically the level of confidence is rated low or very low, yet there is a case for making strong recommendations given the context and evidence.

### ***Need for reporting policy characteristics in evaluations***

This project also highlights a need for both reporting and considering policy characteristics in evaluations more consistently. Documenting these was not as straightforward as anticipated in both primary studies and evidence syntheses due to lack of reporting of information. Yet, these characteristics influenced the interpretation of results. They could also inform study quality or risk of bias. Information that we felt was missing includes the following:

1. Policy names: several policies were not named or had their name changed through time without it being reported in the evaluation.
2. Policy content and context: some publications reported different aspects of the same policy, for example, in Canada some said evaluating trans-fat policies that included both regulatory labelling and voluntary limits, while others only mentioned the limits. We have extracted the latter at face value, but some studies might have missed the wider picture. Also, stating that a policy is a salt reduction programme is not enough: it can consist of awareness campaigns, targets, labelling, regulations in specific settings, or a combination of these.
3. Governance and policy process including the actors involved: for instance, the development of some regulatory and voluntary approaches by the public sector might have involved private actors and should thus rather be called PPPs.
4. Policy and evaluation timeline: the dates of data collection and of key policy changes inform reviewers' understanding of the policy status at the time of data collection, for example decisions about when baseline data were collected: whether it was collected before a policy was debated, or

announced, between the announcement and implementation deadline, just before that deadline, or after, and for how long.

5. Wider context including concurrent initiatives: it is now common to have several initiatives promoting healthy eating occurring at the same time. For instance, from the UK and English governments alone, there are the SDIL, salt and sugar reduction programmes, FOPL, an advertising control code, etc. While it is impossible to assess them all at once, and study authors are not expected to extensively describe them, mentioning the most relevant concurrent interventions could help interpreting results.
6. Policy and evaluation levels: sometimes these did not match. For example, some state policies were evaluated using data aggregated at the national level without considering or mentioning that the policy was implemented in a single state.

### ***Need to recognise the value of studies of environment features and policy documents***

This project showcases the contribution of non-human outcomes for evaluating policies promoting healthy environments. The primacy often accorded by evaluations to health or behavioural outcomes of interventions is frequently inappropriate and unwarranted. First, many evaluations take place over too short a time for measurable changes in outcomes such as obesity, CVD or mortality to manifest themselves.<sup>159</sup> Second, these policies act on the environment rather than directly on humans, alongside other interventions taking place concurrently. This often makes the direct attribution of effects on humans for a specific policy infeasible. The impact of a FOPL scheme or an advertising control policy is highly unlikely to lead to measurable changes in weight status over the course of an evaluation, but it may nevertheless generate intermediate outcomes such as alterations to packaging or reformulation of products.

Moreover, lack of implementation of a policy is not necessarily or simply a bias; from a policy analysis perspective it may also be an outcome. It could be a mistake or might have been deliberately planned not to happen. For example, the systematic reviews on the effectiveness of PPPs and voluntary approaches by private actors (see [Chapters 5](#) and [6](#)) found that companies participating in PPPs or pledges continued to advertise, promote or offer unhealthy foods, including to children. The policy document analyses in the review of PPPs also suggest that some of the policies had very low ambitions, included loopholes, or were not monitored by the companies themselves, suggesting that they were more likely to be intended to promote a 'health halo'<sup>175</sup> and a favourable corporate image than to improve population diet. Other examples of studies that did not involve humans yet provide useful information on policy effectiveness include a governmental evaluation in Canada showing that only 14% of food categories met the national voluntary salt targets after 4 years. Not only was no progress observed for nearly half of the food categories, but sodium content had increased in some of them.<sup>160</sup> A comparison of marketing regulations for breast milk substitutes in Cambodia, Indonesia, Myanmar, Thailand and Vietnam concluded that none followed the WHO recommendation of applying them to children aged up to 36 months.<sup>161</sup> A study by Ejlerskov *et al.*<sup>162</sup> on voluntary checkout policies by 14 supermarket chains in the UK noted that the six chains with 'clear and consistent' policies offered a smaller median proportion of unhealthy foods at their checkouts and that all complied to their policy compared to the six chains with 'vague or inconsistent' policies and the two chains without a policy. In the UK again, an analysis of food industry pledges in the Public Health RD showed that none included the most effective strategies to improve diet.<sup>56</sup>

We suggest attributing a greater value to the contribution of studies of environment features and analysis of policy documents for informing decisions about effectiveness, and to acknowledge this in funding programmes. Such studies also have the advantage of generally requiring less time, resources and advanced evaluation techniques, which makes them more accessible worldwide. This could also be reflected in logic models or systems frameworks more systematically, for instance with the analysis of the policy itself and implementation, to effects on the environment, human behaviours, and human health.

## Implications for future research and research funding

This study highlights three implications for future research and research funding:

### *Studies on the role of corporate actors in food policy*

The role and interests of policy stakeholders, and the accepted legitimacy of corporate actors in food policy, should be critically interrogated with healthy diets for the population as the first priority.

### *Evaluations of real-world policies equitably across geographic regions*

First, future evaluations are needed across all geographic regions of real-world policies to improve food environments equitably. This will require greater global equity in access to research funding. This also includes the need for more cost-effectiveness analyses worldwide.

### *Capture equity dimensions in policy evaluations*

Second, equity dimensions should be adequately built into policy evaluations. Moreover, research funding could be directed to study how policy interventions could appropriately and systematically capture PROGRESS-Plus equity dimensions.

### *Guideline development for quality/risk of bias and certainty in the evidence of policy evaluations*

Third, guidelines should be developed to (1) help with systematically reporting policy characteristics in policy evaluations, (2) consider policy characteristics in the interpretation of results and risk-of-bias appraisal, (3) appraise the risk of bias or study quality of studies measuring environmental features (rather than human outcomes) and using document analyses (including policy and media sources), (4) discussing whether the GRADE framework for assessing certainty in the evidence should consider the feasibility of different types of studies, recognise the contribution of document and media analyses, and differentiate more effectively the level of certainty between good and weak observational studies for policy research.

## Study strengths and limitations

A major strength of the study is the broad coverage of the identified research, covering a wide range of policy topics. However, we may have missed some policy evaluations because the literature searches did not include the names of specific policies, as this was beyond the scope of the resources.

The literature searches were also only conducted in English, which likely explains at least partly the predominance of publications in English, and limited to 2010–20, 2 years before finalising the report. While updating literature searches is common practice for systematic reviews, it was not possible in this case as the scale of the work required to update this series of reviews was far outside the available capacity. Consequently, the findings only represent the years 2010–20 and not the evaluation of policies published after. However, there are no indications that including evidence published after 2020 would have led to different results. On the contrary, since 2020 there have been increasing calls that are aligned with the findings, that is to make policies to improve food environments statutory. For instance, the WHO now explicitly encourages countries to impose taxes on SSBs.<sup>163</sup> Food-EPI, an international standardised tool to benchmark policies, includes the adoption of mandatory food composition targets and FOPL.<sup>164</sup> UNICEF recommends regulating food marketing to children, implementing mandatory food reformulation for added free sugars and salt and/or to reduce portion sizes, and introducing fiscal measures such as taxes on SSBs.<sup>165</sup>

Although the percentages of records screened by two independent reviewers or more independently appear low (12% of titles and abstracts and 33% of eligible full texts), they represented 3346 titles and abstracts and 637 full-text papers. Furthermore, all records excluded for the justifications (or exclusion

codes) for which disagreements were highest were checked by another reviewer to ensure to retrieve some that might have been excluded by error.

Although we included policies across the 'NOURIS' part of the NOURISHING framework, which focuses on the food environment, apart from the systematic evidence map, no result specific to the 'O', representing specific settings including schools, nurseries, health care, and sports and leisure centres, were found. A few systematic reviews on schools had been found but were excluded because the evaluations assessed were not real-world evaluations, the policy or evaluation were conducted at the local level, or the systematic review did not consider the governance approach or did not appraise study quality. The absence of this policy category from the systematic reviews on commitments by private actors and on PPP might be due to most policies in these settings being led by the public sector, although the presence of the private sector is not uncommon.

The systematic evidence map examines the policy and evaluation characteristics of a large body of evidence on a wide range of policies promoting healthy food environments. It also shows that this type of evidence synthesis can do more than identifying trends and gaps in research: it can also be used to question current practices and the use of evidence in policy-making, with practical implications for policy-makers, evaluators and systematic reviewers. Except for health and nutrition claims, food trade and investments, which were not included, the fields are aligned with the International Network for Food and Obesity/Noncommunicable Diseases Research, Monitoring and Action Support framework,<sup>166</sup> a guide developed by a global network and recognised by WHO for monitoring and benchmarking public and private sector interventions aiming to improve food environments. Only a few publications reporting on policies targeting the retail and catering sector were identified. However, the exploration of local evaluations and policies in the UK suggest that this might be because they are more likely to be implemented at a lower jurisdiction level than state or national. Challenges in planning restrictions reported in some of these evaluations also suggest that these actions are not as common as other policy categories.<sup>167,168</sup> Nearly all of the data extraction was verified by a second reviewer. Furthermore, the study design 'follow-up studies and time series' was used to designate studies using the same samples of participants across time or time-series analytical methods, while the study design 'pre-post repeat cross-sectional studies' was used for studies using different samples across time or non-human participants. This difference was sometimes not obvious and might have led to some misclassifications, although it is unlikely to have influenced the conclusions since specific results in the effectiveness reviews were nearly all from the same category (cross-sectional), which limited the role of study design.

As for the scope of the overview of review, from a global perspective, the extent of policies covered was even narrower than those in the systematic evidence map: all policies were from high- and upper-middle countries, and many investigating specific population groups were about the USA and/or about SSB taxes. No policy in schools, health care, nursery or leisure settings were included nor advertising or marketing controls, although the latter topic was further documented with the systematic reviews on commitments by private actors and PPPs. By excluding all systematic reviews that had not conducted a quality appraisal, we are likely to have excluded a greater number than if only those in the lowest of the four original quality categories by SIGN had been excluded as originally planned. Nevertheless, this strategy remained coherent with guidance by Cochrane<sup>32</sup> and the principle that we had set for this overview of reviews consisting in using the most robust evidence. A majority of systematic reviews were appraised as high- or acceptable-quality. However, since only some results sections were considered in most of them, some of which relying on one to four studies, this rating might be less informative than in traditional evidence syntheses.

Data extraction and study quality appraisal for the three systematic reviews assessing effectiveness or cost-effectiveness and for the qualitative review were fully conducted by two independent researchers or checked by another. Some of the tools were slightly modified but this was done through careful discussions and testing among the reviewers. The only reference lists that were screened were those of evaluations included in the systematic review on private commitments, the systematic review on cost-effectiveness, the evidence syntheses on cost-effectiveness excluded from the overview of reviews, and

the overviews of reviews retrieved in the overarching search. Yet, none of the 33 publications included in the evidence map retrieved outside databases contributed to the systematic review on private commitments and cost-effectiveness; thus, selection bias in that matter is unlikely.

Results for the overview of reviews (see [Chapter 4](#)) and the systematic review on private commitments (see [Chapter 6](#)) were summarised using effect direction plots. Such tabulations give a general sense of the results by graphically representing the direction of effects of multiple heterogeneous and non-standardised outcomes, which are normally difficult to gauge in text format, along with sample sizes and overall study quality or risk of bias. However, they do not consider effect size nor precision estimates.

## Equality, diversity and inclusion

### *Relevant to the reviewed literature*

This study did not include participants as it was an evidence synthesis based on a large complex systematic review of the literature. However, most of the systematic reviews included the reporting of equity domains in the evidence, as per the PROGRESS-Plus equity dimensions. The systematic evidence map (see [Chapter 3](#)) reports that of the nearly 400 publications assessing policy effectiveness, only 50% assessed at least one equity domain: age was the most assessed (30%), followed by education (16%, although these mainly related to school characteristics), SES at the individual level (15%), gender/sex (13%), race and culture (11%) and place (8%), whereas only 11 publications considered occupation, and one or two examined religion, social capital and disability each. The Overview of Reviews (see [Chapter 4](#)) reported findings by PROGRESS-Plus categories and found a lack of reporting of outcomes in systematic reviews for specific population groups: overall, evidence on specific population groups is patchy, incomplete, mainly inconsistent, and largely relies on single studies (although some of these had large samples) rather than aggregated bodies of evidence. This limitation in the research is reflected in the recommendations.

## Patient and public engagement

A public advisory group was formed and included. They took part in a consultation at the start of this systematic review, on 21 October 2020. At the meeting we introduced the project and the role of the public advisory group: to provide a public view on what we are planning, and also to get their views about the role of the public in policies to improve diet in England, and how to reflect this in the research.

The PI's initial thoughts on the role of the public in diet policies were as follows:

- Health is often a secondary priority when planning and preparing food due to competing priorities. Participants were favourable to having interventions that promote healthier diets.
- Some participants were not aware of some of the UK policies shown, such as the voluntary action to reduce trans-fat and the RD.
- Most of the policies discussed were those that can be seen and used by consumers on a daily basis, such as product labelling and school food standards. Bringing the conversation to how policy is shaped and their process was more challenging, potentially because this is happening at a higher level, and is not commonly discussed openly.
- Regarding the involvement of the public in informing these policies, one participant said that the public can put pressure on governments or work with organisations that do this. Another participant expressed a feeling of powerlessness towards the school food standards.
- Public consultations (as a way of increasing the public voice in policy) were discussed. One participant said that the recruitment process should be more transparent and include people from diverse groups to be more representative of the general population. Another pointed out that while this would be

useful, this would also be time-consuming and costly for the government, so a balance between the two would be needed.

Due to (1) the complexity of the systematic review (requiring additional ad hoc staff); (2) the practical challenges presented by the COVID-19 pandemic and (3) the challenge of meaningfully engaging members of the public on a systematic review of policy effectiveness, cost-effectiveness and process, this was in the end the only public advisory group meeting of the project.

Though we acknowledge the importance of the public voice in policies that are designed to serve and support them, we were not able in the end to give this point sufficient space and priority.

## Conclusions

This study generated the first review of a wide range of real-world evaluations of policies to improve food environments, from an effectiveness, cost-effectiveness and policy process perspective. From the available evidence reviewed, we found that regulatory approaches appear the most effective, with voluntary industry approaches and PPPs having limited effectiveness. These findings should be carefully considered in future public health policy development, as should the findings of geographic imbalance in the evidence and inadequate representation of equity dimensions across the policy evaluations. We find that policies aiming to improve food environments are at times driven by factors other than evidence and shaped by compromise and pragmatism. This study concludes that these policies should be first and foremost designed and driven by the evidence of greatest effectiveness to improve food environments for healthier diets. The role and interests of policy stakeholders, and the accepted legitimacy of corporate actors in food policy, should be critically interrogated with healthy diets for the population as the first priority.





# Additional information

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## Contributions of authors

**Laurence Blanchard** (<https://orcid.org/0000-0003-0090-917X>) (Research Fellow) managed the study; led the overarching review design, data extraction, quality appraisal (see [Chapter 2](#)), designed and led the Evidence Map (see [Chapter 3](#)) and the Overview reviews (see [Chapter 4](#)).

**Stephanie Ray** (<https://orcid.org/0000-0001-8403-9233>) was a researcher on the project; she contributed to overarching review design, screening, data extraction; data extraction and quality appraisal for the overview of reviews (see [Chapter 4](#)), and she designed and led the review of voluntary approaches (see [Chapter 7](#)).

**Cherry Law** (<https://orcid.org/0000-0003-0686-1998>) (Lecturer) was a coinvestigator and was involved in the following: conceptualisation, methodology, writing (review and editing) and funding acquisition. She led the review of cost-effectiveness (see [Chapter 8](#)).

**María Jesús Vega-Salas** (<https://orcid.org/0000-0002-5798-7091>) was a researcher on the project; she contributed to screening for the overarching project (see [Chapter 2](#)) review design, and data extraction.

**Julia Bidonde** (<https://orcid.org/0000-0001-7535-678X>) was a researcher on the project; she contributed to data extraction, quality appraisal, specifically [Chapters 5](#) and [6](#).

**Gemma Bridge** (<https://orcid.org/0000-0001-7441-9849>) (Independent Consultant) was a researcher on the project; she contributed to data extraction, quality appraisal, specifically [Chapters 5](#) and [6](#) and the plain English summary.

**Matt Egan** (<https://orcid.org/0000-0002-4040-200X>) (Professor) was a coinvestigator and was involved in the following: conceptualisation, methodology, writing (review and editing) and funding acquisition. He advised on the overarching design and conduct of the systematic review throughout.

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**Cécile Knai** (<https://orcid.org/0000-0001-6663-7379>) (Professor of Public Health Policy) was the principal investigator and directed the review. She oversaw all stages and components including synthesis of the evidence and creation of the final report. She led the review of policy process studies (see [Chapter 5](#)) and the systems map (see [Chapter 9](#)).

All authors contributed to, read and approved the final manuscript.

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**Full disclosure of interests:** Completed ICMJE forms for all authors, including all related interests, are available in the toolkit on the NIHR Journals Library report publication page at <https://doi.org/10.3310/JYWP4049>.

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### Data-sharing statement

This is a systematic review of the literature and, therefore, the material generated beyond that contained within the report is not suitable for sharing. Further information can be obtained from the corresponding author.

### Ethics statement

This is a systematic review of the literature and therefore, the research did not require ethical approval.

### Information governance statement

Our study did not handle any personal information.

### Department of Health and Social Care disclaimer

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This monograph was published based on current knowledge at the time and date of publication. NIHR is committed to being inclusive and will continually monitor best practice and guidance in relation to terminology and language to ensure that we remain relevant to our stakeholders.

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# Appendix 1 Search strategies

## Literature search structure and explanations

The search strategy will include five key lines (in green) and an additional three (in pink) for databases that use MeSH terms. They are built around the concepts below. Exclusion keywords will then be added.

**TABLE 24** Coding tool intended to be used in the order presented, for example studies must pass criterion EX 1 to be assessed for criterion EX 2

Exclusion code	Included	Excluded
EX 1.1: Before 2010	Published between 2010 and 2020	Published before 2010
EX 1.2: After 2020	Published from 2021	Published after 2020
EX 2-3: - Not diet, - Not food environment, - Excluded food environment topics	Policies that ... - Apply to 'ordinary' food including baby formulas, for example as in the Eatwell guide (NHS 2019); <b>AND</b> - Aim to promote healthy food environments (i.e. food proximity, affordability, marketing and information) of public spaces; <b>AND</b> - Aims to address the main dietary risk factors associated with the burden of disease in England	<ul style="list-style-type: none"> <li>- Not diet-related or not targeting ordinary food, for example 'natural' products, supplements, alcohol, functional foods, gluten free, GMOs, sweeteners, ingredients not intended to be sold to the general public (e.g. emulsifiers);</li> <li>- Breastfeeding since it is produced and available differently than for other food and drinks;</li> <li>- Not on the food environment, e.g. education campaigns and interventions, clinical or therapeutic interventions;</li> <li>- Health claims, food fortification, and international trade (e.g. exports/imports), finance, regulation of free markets, customs duties despite being on the food environment;</li> <li>- General taxes (e.g. sales taxes not specific to food, taxes on income), tax evasion, service charge; food safety, hygiene, allergies, accuracy of nutrition values on labelling;</li> <li>- Energy drinks when evaluations are about their interaction with alcohol or caffeine since this is more of a safety issue. <b>INCLUDE energy drinks when they are considered as a sugary drink;</b></li> <li>- Agriculture and farming as a primary focus rather healthy diet (e.g. involving local farms in schools to support the latter rather than to improve health);</li> <li>- Food security, undernutrition, or double/triple burden of malnutrition, e.g. feeding/ supplementation programmes, IYCF for undernutrition, vouchers, cash-transfer programmes, food and milk banks and other food redistribution programmes, international food aid or assistance, because interventions relevant for England tend to target individuals rather than environments <b>INCLUDE free school meals that are considered from a school food environment perspective;</b></li> </ul>

continued

**TABLE 24** Coding tool intended to be used in the order presented, e.g. studies must pass criterion EX 1 to be assessed for criterion EX 2 (*continued*)

Exclusion code	Included	Excluded
		<ul style="list-style-type: none"> <li>- Food sustainability as a primary focus rather than healthy diet (e.g. research on organic products, climate change or animal welfare not aiming to improve diet directly);</li> <li>- About research collaboration as a topic;</li> <li>- Historic research.</li> </ul>
EX 4: Not general population	<p>The policies aim to improve the health of the general public. This includes the following:</p> <ul style="list-style-type: none"> <li>- The general public in a workplace accessible to all, for example clients in a restaurant, visitors in a hospital canteen;</li> <li>- Children in schools and nurseries.</li> </ul>	<p>The policy only targets</p> <ul style="list-style-type: none"> <li>- Staff in a workplace;</li> <li>- Patients or people with specific health conditions;</li> <li>- Athletes;</li> <li>- The army.</li> </ul>
EX 5: Not real-life policy	<p>Data were collected:</p> <ul style="list-style-type: none"> <li>- At least once when the policy was adopted or implemented; or</li> <li>- As part of a state or national public consultation.</li> </ul> <p>Experiments, simulations and projections are included when based on 'real-world' policy data defined as above.</p>	<ul style="list-style-type: none"> <li>- Experiments in non-real-life environments, for example online or in laboratories;</li> <li>- Studies that only use data collected before the policy was adopted or implemented or testing policy scenarios;</li> <li>- Research initiatives, for example a trial testing a new approach that is not part of a state/national/international policy;</li> <li>- Evidence syntheses and comparative studies that have a great proportion of policies not meeting this criterion and that don't exclude them from at least part of the analyses, for example using subgroup analyses.</li> </ul>
EX 6: Local POLICY level	<p>Policies implemented at the</p> <ul style="list-style-type: none"> <li>- International level;</li> <li>- National level;</li> <li>- Provincial/state level;</li> <li>- Anywhere from the UK passes this criterion (but see EX 13).</li> </ul>	<ul style="list-style-type: none"> <li>- Policies implemented at a lower level than the state (<i>except in the UK, which passes this criterion</i>).</li> <li>- Evidence syntheses and comparative studies that have a great proportion of policies not meeting this criterion and that don't exclude them from at least part of the analyses, for example using subgroup analyses.</li> </ul>
EX 7: Local EVALUATION level	<p>Evaluations conducted:</p> <ul style="list-style-type: none"> <li>- At a state, national or international level</li> <li>- In the UK (any level passes this criterion, but see EX 13);</li> <li>- Not at a state level but represent a big part of a country, or multiple places across a country or state;</li> <li>- Audits of food products, shops and TV adverts can be conducted at any level unless the evaluation specifies focusing on local independent stores or TV channels.</li> </ul>	<ul style="list-style-type: none"> <li>- Evaluations conducted at a lower level than state, for example city, or a few institutions not selected to represent a state or more;</li> <li>- Evaluations that cannot represent a country or state, for example conducted in two schools.</li> <li>- Evidence syntheses that have a great proportion of evaluations not meeting this criterion and that don't exclude them from at least part of the analyses, e.g. using subgroup analyses.</li> </ul>
EX 8: Not evaluation	<ul style="list-style-type: none"> <li>- Primary research evaluations;</li> <li>- Evidence syntheses that have searched at least two databases, mention eligibility criteria, AND clearly indicate which studies are included (e.g. in a table, series of references at the start of the results section or within each section without needing to track down each reference to make the whole list).</li> </ul>	<ul style="list-style-type: none"> <li>- Reviews that do not meet the inclusion criteria for evidence syntheses identified to the left;</li> <li>- Theoretical papers, commentaries, viewpoints, editorials, letters;</li> <li>- Conference abstracts, dissertations, theses;</li> <li>- Study protocols, working papers, pre-prints;</li> <li>- Websites, blogs, podcasts, book reviews, book chapters.</li> </ul>



**TABLE 24** Coding tool intended to be used in the order presented, e.g. studies must pass criterion EX 1 to be assessed for criterion EX 2 (*continued*)

Exclusion code	Included	Excluded
EX 9: Policy mapping	Studies assessing effectiveness, cost-effectiveness, factors influencing policy development or implementation, responses to public consultations, or media coverage of a policy.	Studies solely inventorying ('mapping') the presence of policies in countries or regions and/or benchmarking their implementation.
EX 10: Views about the general public	<ul style="list-style-type: none"> <li>- Studies assessing the views of the general public as part of a state or national public consultation;</li> <li>- Studies assessing the views of the public in the UK pass this criterion, but see EX 13.</li> </ul>	<ul style="list-style-type: none"> <li>- Studies assessing the views of the general public (<b>except in the UK in which case they are INCLUDED</b>);</li> <li>- Evidence syntheses that have a great proportion of studies not meeting this criterion and that don't exclude them from at least part of the analyses, for example using subgroup analyses.</li> </ul>
EX 11 : Insufficient focus on governance (multipolicies)	<ul style="list-style-type: none"> <li>- Primary research evaluations assessing multiple policies and that indicate, at least broadly, the governance approach of these or analyse them by governance approach;</li> <li>- Evidence syntheses that analyse policies taking their governance approach into account.</li> </ul>	<ul style="list-style-type: none"> <li>- Primary research evaluations assessing multiple policies that have unclear governance;</li> <li>- Evidence syntheses that do not consider governance in their analysis (including when the governance approach of each policy is stated but the analysis does not consider it).</li> </ul>
EX 12: Overviews of reviews	<ul style="list-style-type: none"> <li>- Primary research evaluations;</li> <li>- Evidence syntheses of primary studies (may also include very few evidence syntheses within them).</li> </ul>	Overview of reviews (also called umbrella reviews) and other types of evidence syntheses of literature reviews.
EX 13 - UK local level - UK views of general public	<p>(This is simply to group studies about the UK together);</p> <ul style="list-style-type: none"> <li>- Studies not focusing on local policies or evaluations (as defined in EX 6 and EX-7) in the UK;</li> <li>- Studies not assessing the views of the general public in the UK outside public consultations.</li> </ul>	<ul style="list-style-type: none"> <li>- Studies focusing on local policies or evaluations (as defined in EX 6 and EX-7) in the UK;</li> <li>- Studies assessing the views of the general public in the UK outside public consultations;</li> <li>- Evidence syntheses that have a great proportion of studies not meeting this criterion and that don't exclude them from at least part of the analyses, for example using subgroup analyses.</li> </ul>
Duplicate	Documents that are not identical.	Identical documents (only keep one of them).
<b>INCLUDE</b>	Publications passing ALL the inclusion criteria above.	Publications failing at one of the exclusion criteria above or more.

GMO, genetically modified organism.

### ➔ Diet + Actor + Policy + Governance (i.e. Regulatory-Voluntary-PPP)

Numerous individual keywords, MeSH terms, truncations and Boolean terms were tested individually and/or combined with other terms to verify their scope. For instance, the word 'Act' was considered to identify policies but discarded because of its omnipresence due to the verb 'to act'. 'Menu', 'Portion size' and 'serving size' were added to capture policies on these that are not described in titles and abstracts using food or nutrient terms. Regarding truncation, tax\* was removed because it also includes 'taxa', which is highly used in the biochemistry literature. Instead, we will be using tax, taxes, taxed, taxation and taxing. The use of AND versus ADJ5, as well as ADJ5 versus ADJ4 were also compared to verify what they include and exclude and therefore balance sensitivity with precision. The platform Web of Science does not use MeSH or thesaurus terms and produces several thousands of results. Therefore, only free terms can be excluded with 'NOT', which is not sufficient. To help reducing the number of

irrelevant papers about agriculture, microbiology, genetics and pharmacology, we will select the relevant fields using the Web of Science categories (e.g. any category about health, food, social sciences; not engineering nor agriculture).

**Keywords related to: Diet**

1. diet free terms;
2. diet MeSH;
3. 1 OR 2 (Diet terms and MeSH).

**Keywords related to: Regulatory policies or PPP + Diet**

4. MeSH Food Legislation;
5. law free terms ADJ5 1;
6. ( Legislation MeSH or Tax MeSH or Fiscal policy MeSH) AND 3;
7. (PPP free terms or MeSH) AND 3.

**Keywords related to: Diet-related policies + Governance**

8. Governance free terms.mp;
9. Governance MeSH terms;
10. (MeSH Nutrition Policy OR MeSH food Labelling) OR MeSH Food Assistance AND (8 or 9).

**Keywords related to: Actors + Policy + Governance + Diet**

11. government free terms;
12. government MeSH terms;
13. industry free terms;
14. industry MeSH terms;
15. policy free terms;
16. policy-Making MeSH;
17. (11 or 12 or 13 or 14) AND (15 or 16) AND (8 or 9) AND 3;
18. (13 adj5 partnerships free terms) AND 3;
19. 'policy option or policy options' AND 3.

**Combining the eight strategies**

20. 4 or 5 or 6 or 7 or 10 or 17 or 18 or 19.

**Keywords excluded**

21. exp Pharmacology;
22. exp Food safety/;
23. exp Hygiene/;
24. exp Food hypersensitivity;
25. exp genetics/ or exp toxicology/;
26. exp cell physiological phenomena/ or exp genetic phenomena/ or exp microbiological phenomena/;
27. exp heterocyclic compounds/ or exp polycyclic compounds/ or exp macromolecular substances/ or exp 'hormones, hormone substitutes, and hormone antagonists'/ or exp 'enzymes and coenzymes'/ or exp 'nucleic acids, nucleotides, and nucleosides'/ or exp complex mixtures/ or exp biological factors/ or exp 'biomedical and dental materials'/;
28. (Cell\* or mitochondr\* or labell\* or mononucl\* or nucle\* or reductase or abellin\* or oxydat\* or oxidase or homeostas\* or overexpress\* or phenotype\* or embryo\* or labelling\* or PCR or RNA or gene or genes or genetic\* or ((calcium or salt or sodium) adj2 ion)).mp;

29. exp animals/ not humans/;
30. 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 ... . And additional relevant terms;
31. 21 NOT 31;
32. from 2000 – current.

### **Literature search strategy in MEDLINE (Ovid)**

The eight key search lines are identified in green (five key lines) and pink (three additional lines depending on MeSH terms availability in each database).

1. exp Diet/
2. exp Food/
3. beverages/ or exp artificially sweetened beverages/ or exp carbonated beverages/ or exp coffee/ or exp drinking water/ or exp energy drinks/ or exp 'fruit and vegetable juices'/ or exp milk/ or exp milk substitutes/ or exp sugar-sweetened beverages/
4. exp Fruit/
5. exp Vegetables/
6. exp Sodium, Dietary/
7. exp Sugars/
8. exp Fats/
9. exp Dietary Fiber/
10. exp Portion Size/ or exp Serving Size/
11. exp Infant Food/ or exp Infant Formula/
12. (Diet or Nutrition or Food or foods or Snack or snacks or Drink or drinks or Beverage\* or Soda or sodas or Fruit or fruits or Vegetable\* or Salt or Sodium or Sugar\* or Fat or fats or fatty acids or TFAs or Fibre or fibres or fiber or fibers or 'Portion size\*' or 'Serving size\*' or Menu or menus or Infant formula or infant formulas or baby formula or baby formulas or baby milk or infant milk or artificial milk or breastmilk substitute\* or breast milk substitute\*).ti,ab.
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 **[Food free + MeSH terms]**
14. exp Legislation, Food/ **[semi-final line 1; for food policies that are clearly regulatory]**
15. (Law or laws or Legislat\* or Regulat\* or Decree or 'Executive order' or Tax or taxes or taxation or taxed or taxing or Levy or levies or levied or 'Excise duty' or 'fiscal policy' or 'fiscal policies' or 'fiscal measure' or 'fiscal measures').ti,ab. **[terms related to policies that are regulatory]**
16. ((Law or laws or Legislat\* or Regulat\* or Decree or 'Executive order' or Tax or taxes or taxation or taxed or taxing or Levy or levies or levied or 'Excise duty' or 'fiscal policy' or 'fiscal policies' or 'fiscal measure' or 'fiscal measures') adj5 (Diet or Nutrition or Food or foods or Snack or snacks or Drink or drinks or Beverage\* or Soda or sodas or Fruit or fruits or Vegetable\* or Salt or Sodium or Sugar\* or Fat or fats or fatty acids or TFAs or Fibre or fibres or fiber or fibers or 'Portion size\*' or 'Serving size\*' or Menu or menus or Infant formula or infant formulas or baby formula or baby formulas or baby milk or infant milk or artificial milk or breastmilk substitute\* or breast milk substitute\*).ti,ab. **[semi-final line 2; 15 adj5 12, for policies that are regulatory + food free terms]**
17. exp Fiscal Policy/ or exp Taxes/
18. exp Government Regulation/
19. 17 or 18 **[MeSH terms associated with policies that are regulatory or about governance]**
20. 19 and 13 **[semi-final line 3; MeSH policies that are regulatory + food]**
21. ('Public-private partnership\*' or 'Responsibility Deal').mp. **[terms clearly related to PPPs]**
22. exp Public-Private Sector Partnerships/
23. 21 or 22 **[free key words + MeSH clearly about PPP]**
24. 23 and 13 **[semi-final line 4; clearly PPP + food]**
25. (Regulatory or Compulsory or Obligat\* or obliged or Voluntary or Option\* or Non-compulsory or Non-regulatory or Non-obligatory or Public-Private).mp. **[terms related to governance]**
26. exp Regulatory Reporting/ or exp Regulatory Programs/
27. exp Voluntary Programs/

28. 25 or 26 or 27 [**free and MeSH terms related to governance**]
29. exp Nutrition Policy/
30. exp Food Labeling/
31. exp Food Assistance/
32. 29 or 30 or 31 [**policies that are clearly about food**]
33. 28 and 32 [**semi-final line 5; governance + food-related policies**]
34. (Government\* or Governance or Minist\* or Senate or ((National or federal or state or provincial) adj (department or agency or institute))),ti,ab. [**free words related to the national or state public sector**]
35. government/ or exp federal government/ or exp government agencies/ or exp state government/
36. (Industry or industries or Private or Business\* or Public-private or Company or companies or Corporat\* or Multinational\* or Vendor\* or Retail\* or Shop or shops or Store or stores or supermarket\* or Restaura\* or Broadcaster\*).ti,ab. [**free terms related to relevant private sectors**]
37. exp Food-Processing Industry/ or exp Food Industry/
38. exp Restaurants/
39. exp Food Services/
40. 34 or 35 or 36 or 37 or 38 or 39 [**free and MeSH terms about the public and private sectors**]
41. (Policy or policies or Plan or Strategy or strategies or Standard or standards or Scheme\* or Program\* or Guide or guides or guidance or guidelines or Code or codes or Measure or Measures or Rulebook or Target or targets or Limit or limits or limitation or Reformulat\* or Remov\* or Restrict\* or Prohibit\* or Ban or bans or banned or Label\* or Population intervention\* or population-level intervention\* or population-based intervention\*).ti,ab. [**free terms frequently used to name diet-related policies**]
42. exp Policy Making/
43. 41 or 42 [**free and MeSH terms about policy**]
44. 13 and 28 and 40 and 43 [**semi-final line 6; food + governance + public/private actors + policy**]
45. (Agreement\* or Alliance\* or Coalition\* or Collaboration or Cooperation or 'Joint deliver\*' or Partnership\* or Pledge\* or Self-regulat\*).ti,ab. [**free terms related to partnership**]
46. ((Agreement\* or Alliance\* or Coalition\* or Collaboration or Cooperation or 'Joint deliver\*' or Partnership\* or Pledge\* or Self-regulat\*) adj5 (Industry or industries or Private or Business\* or Public-private or Company or companies or Corporat\* or Multinational\* or Vendor\* or Retail\* or Shop or shops or Store or stores or supermarket\* or Restaura\* or Broadcaster\*).ti,ab. [**45 adj5 36, to identify partnerships with private actors free terms**]
47. 46 and 13 [**semi-final line 7; partnerships with private actors + food**]
48. ('policy option' or 'policy options').mp.
49. 48 and 13 [**semi-final line 8; policy options + food**]
50. 14 or 16 or 20 or 24 or 33 or 44 or 47 or 49 [combination of the 8 strategies]
51. exp Pharmacology/
52. exp Food Safety/
53. exp Hygiene/
54. exp Food Hypersensitivity/
55. exp Genetics/
56. exp Toxicology/
57. exp cell physiological phenomena/ or exp genetic phenomena/ or exp microbiological phenomena/
58. exp heterocyclic compounds/ or exp polycyclic compounds/ or exp macromolecular substances/ or exp 'hormones, hormone substitutes, and hormone antagonists'/ or exp 'enzymes and coenzymes'/ or exp 'nucleic acids, nucleotides, and nucleosides'/ or exp complex mixtures/ or exp biological factors/ or exp 'biomedical and dental materials'/
59. (Cell\* or mitochondr\* or labell\* or mononucl\* or nucle\* or reductase or labellin\* or oxydat\* or oxidase or homeostas\* or overexpress\* or phenotype\* or embryo\* or labelling\* or PCR or RNA or gene or genes or genetic\* or ((calcium or salt or sodium) adj2 ion)).mp.
60. exp animals/ not humans/
61. exp Animal Experimentation/
62. exp Hydrocarbons/
63. exp Forensic Genetics/

64. exp pharmacologic actions/
65. exp plant extracts/ or exp prescription drugs/
66. exp Drug Therapy/
67. exp Biopharmaceutics/
68. 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67
69. 50 not 68
70. limit 69 to yr="2000 -Current"
71. exp address/ or exp bibliography/ or exp biography/ or exp collected work/ or exp collection/ or exp comment/ or exp congress/ or exp dataset/ or exp dictionary/ or exp directory/ or exp editorial/ or exp guideline/ or exp lecture/ or exp letter/ or exp news/ or exp newspaper article/ or exp overall/ or exp periodical index/ or exp video-audio media/ or exp webcast/
72. 70 not 71

## Articles used to test the search strategy

### Primary research

1. Allen K, Pearson-Stuttard J, Hooton W, Diggle P, Capewell S, O'Flaherty M. Potential of trans fats policies to reduce socioeconomic inequalities in mortality from coronary heart disease in England: cost-effectiveness modelling study. *BMJ* 2015;**351**:h4583.
2. Barquera S, Campos I, Rivera JA. Mexico attempts to tackle obesity: the process, results, push backs and future challenges. *Obes Rev* 2013;**14**:69–78.
3. Batis C, Rivera JA, Popkin BM, Taillie LS. First-year evaluation of Mexico's tax on nonessential energy-dense foods: an observational study. *PLOS Med* 2016;**13**:e1002057.
4. Bertolo RF, Hentges E, Makarchuk MJ, Wiggins AKA, Steele H, Levin J, *et al*. Key attributes of global partnerships in food and nutrition to align research agendas and improve public health. *Appl Physiol Nutr Metab* 2018;**43**:755–8.
5. Buhler S, Raine KD, Arango M, Pellerin S, Neary NE. Building a strategy for obesity prevention one piece at a time: the case of sugar-sweetened beverage taxation. *Can J Diabetes* 2013;**37**:97–102.
6. Cappuccio FP, Capewell S, Lincoln P, McPherson K. Policy options to reduce population salt intake. *BMJ* 2011;**343**:d4995. [not captured by the search because no abstract]
7. Caro JC, Corvalán C, Reyes M, Silva A, Popkin B, Taillie LS. Chile's 2014 sugar-sweetened beverage tax and changes in prices and purchases of sugar-sweetened beverages: an observational study in an urban environment. *PLOS Med* 2018;**15**:e1002597.
8. Castronuovo L, Allemandi L, Tiscornia V, Champagne B, Campbell N, Schoj V. Analysis of a voluntary initiative to reduce sodium in processed and ultra-processed food products in Argentina: the views of public and private sector representatives. *Cad Saude Publica* 2017;**33**:e00014316.
9. Cobiac LJ, Vos T, Veerman JL. Cost-effectiveness of interventions to reduce dietary salt intake. *Heart* 2010;**96**:1920–5.
10. Collins M, Mason H, O'Flaherty M, Guzman-Castillo M, Critchley J, Capewell S. An economic evaluation of salt reduction policies to reduce coronary heart disease in England: a policy modelling study. *Value Health* 2014;**17**:517–24.
11. Collins SM. Legislative perspectives on diabetes in America. *Endocr Pract* 2002;**8**:17–8. [not captured by the search but focuses on diabetes]
12. Craddock AL, Kenney EL, McHugh A, Conley L, Mozaffarian RS, Reiner JF, Gortmaker SL. Evaluating the impact of the healthy beverage executive order for city agencies in Boston, Massachusetts, 2011–2013. *Prev Chronic Dis* 2015;**12**:E147.
13. Dixon J, Sindall C, Banwell C. Exploring the intersectoral partnerships guiding Australia's dietary advice. *Health Promot Int* 2004;**19**:5–13.
14. Durand MA, Petticrew M, Goulding L, Eastmure E, Knai C, Mays N. An evaluation of the Public Health Responsibility Deal: informants' experiences and views of the development, implementation and achievements of a pledge-based, public-private partnership to improve population health in England. *Health Policy* 2015;**119**:1506–14.

15. Dutton DJ, Campbell NR, Elliott C, McLaren L. A ban on marketing of foods/beverages to children: the who, why, what and how of a population health intervention. *Can J Public Health* 2012;**103**:100–2. PubMed PMID: 22530530. [not captured by the search. The '/' seems to be problematic – Ovid doesn't see 'foods' and 'beverages' as separate terms]
16. Elbel B, Mijanovich T, Kiszko K, Abrams C, Cantor J, Dixon LB. The introduction of a supermarket via tax-credits in a low-income area. *Am J Health Promot* 2017;**31**:59–66. <https://doi.org/10.4278/ajhp.150217-QUAN-733>. Epub 2016 Nov 18.
17. Fernandez MA, Desroches S, Marquis M, Turcotte M, Provencher V. Facilitators and barriers experienced by federal cross-sector partners during the implementation of a healthy eating campaign. *Public Health Nutr* 2017;**20**:2318–28.
18. Fernandez MA, Desroches S, Turcotte M, Marquis M, Dufour J, Provencher V. Factors influencing the adoption of a healthy eating campaign by federal cross-sector partners: a qualitative study. *BMC Public Health* 2016;**16**:904.
19. Godin KM, Hammond D, Chaurasia A, Leatherdale ST. Examining changes in school vending machine beverage availability and sugar-sweetened beverage intake among Canadian adolescents participating in the COMPASS study: a longitudinal assessment of provincial school nutrition policy compliance and effectiveness. *Int J Behav Nutr Phys Act* 2018;**15**:121.
20. Grabovac I, Hochfellner L, Rieger M, Jewell J, Snell A, Weber A, et al. Impact of Austria's 2009 trans fatty acids regulation on all-cause, cardiovascular and coronary heart disease mortality. *Eur J Public Health* 2018;**28**:4–9.
21. Harris DM, Seymour J, Grummer-Strawn L, Cooper A, Collins B, DiSogra L, et al. Let's move salad bars to schools: a public-private partnership to increase student fruit and vegetable consumption. *Child Obes* 2012;**8**:294–7.
22. He FJ, Brinsden HC, MacGregor GA. Salt reduction in the United Kingdom: a successful experiment in public health. *J Hum Hypertens* 2014;**28**:345–52.
23. Kraak VI, Story M, Wartella EA. Government and school progress to promote a healthful diet to American children and adolescents: a comprehensive review of the available evidence. *Am J Prev Med* 2012;**42**:250–62.
24. Kerins C, McSharry J, Hayes C, Perry IJ, Geaney F, Kelly C. Barriers and facilitators to implementation of menu labelling interventions to support healthy food choices: a mixed methods systematic review protocol. *Syst Rev* 2018;**7**:88.
25. Knai C, James L, Petticrew M, Eastmure E, Durand MA, Mays N. An evaluation of public-private partnership to reduce artificial trans fatty acids in England, 2011–16. *Eur J Public Health* 2017;**27**:605–608.
26. Lehmann U, Charles VR, Vlassopoulos A, Masset G, Spieldenner J. Nutrient profiling for product reformulation: public health impact and benefits for the consumer. *Proc Nutr Soc* 2017;**76**:255–264.
27. Miller GF, Sliwa S, Brener ND, Park S, Merlo CL. School district policies and adolescents' soda consumption. *J Adolesc Health* 2016;**59**:17–23.
28. Moore SG, Donnelly JK, Jones S, Cade JE. Effect of educational interventions on understanding and use of nutrition labels: a systematic review. *Nutrients* 2018;**10**:E1432.
29. Nakamura R, Mirelman AJ, Cuadrado C, Silva-Illanes N, Dunstan J, Suhrcke M. Evaluating the 2014 sugar-sweetened beverage tax in Chile: an observational study in urban areas. *PLOS Med* 2018;**15**:e1002596.
30. Flaherty M, Flores-Mateo G, Nnoaham K, Lloyd-Williams F, Capewell S. Potential cardiovascular mortality reductions with stricter food policies in the United Kingdom of Great Britain and Northern Ireland. *Bull World Health Organ* 2012;**90**:522–31.

### Literature reviews

1. An R. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. *Public Health Nutr* 2013;**16**:1215–28.
2. Brownell KD, Farley T, Willett WC, Popkin BM, Chaloupka FJ, Thompson JW, Ludwig DS. The public health and economic benefits of taxing sugar-sweetened beverages. *N Engl J Med* 2009;**361**:1599–605.

3. Campos S, Doxey J, Hammond D. Nutrition labels on pre-packaged foods: a systematic review. *Public Health Nutr* 2011;**14**:1496–506.
4. Deliens T, Van Crombruggen R, Verbruggen S, De Bourdeaudhuij I, Deforche B, Clarys P. Dietary interventions among university students: a systematic review. *Appetite* 2016;**105**:14–26.
5. Hashem KM, He FJ, MacGregor GA. Systematic review of the literature on the effectiveness of product reformulation measures to reduce the sugar content of food and drink on the population's sugar consumption and health: a study protocol. *BMJ Open* 2016;**6**:e011052.
6. Hyseni L, Bromley H, Kypridemos C, O'Flaherty M, Lloyd-Williams F, Guzman-Castillo M, *et al.* Systematic review of dietary trans-fat reduction interventions. *Bull World Health Organ* 2017;**95**:821–30G.
7. Powell LM, Chriqui JF, Khan T, Wada R, Chaloupka FJ. Assessing the potential effectiveness of food and beverage taxes and subsidies for improving public health: a systematic review of prices, demand and body weight outcomes. *Obes Rev* 2013;**14**:110–28.
8. Thow AM, Jan S, Leeder S, Swinburn B. The effect of fiscal policy on diet, obesity and chronic disease: a systematic review. *Bull World Health Organ* 2010;**88**:609–14.





## Appendix 2 Protocol deviations and clarifications

A modified protocol version was submitted to the NIHR in December 2022. This section presents additional modifications made on the final version of the protocol.

### Quality appraisal tool in [Chapters 5 and 6](#)

For the systematic reviews of PPPs (see [Chapter 5](#)) and of voluntary approaches (see [Chapter 6](#)), study quality was assessed using a modified version of the Newcastle–Ottawa Scale for cross-sectional studies rather than with ROBINS-I. The latter was discarded after facing issues when trialling it on a few studies. The main challenge was that ROBINS-I was designed for follow-up (cohort) studies of interventions that are assumed to be planned or controlled. This assumption did not apply well to the policy evaluations that we had, making the questions about cointerventions, classification of interventions, and deviations from intended interventions difficult to judge meaningfully. We chose instead the Newcastle–Ottawa Scale, which has been widely used and allows identification of the main weaknesses of studies in a pragmatic manner. We selected a version for cross-sectional studies to match with the study designs included in the reviews. We developed additional guidance for studies of documents and environmental features, which is lacking in most tools, and for providing an overall judgement given that the original tool uses a scoring system and this is now discouraged by Cochrane. See [Chapter 2](#) for more details.

### Synthesis approach in [Chapter 8](#)

We conducted a narrative and interpretive synthesis of the qualitative studies of policy process, and quality assessed the papers using CASP. This is in response to the reviewers' comments about the earlier version not meeting the criteria of a critical interpretive synthesis, which we agree was not appropriate in the end.

### Use of the GRADE framework

We had planned to use the GRADE approach in the overview of reviews and the systematic reviews on private commitments and PPPs (see [Chapters 4–6](#)), but this was not possible for the reasons detailed in [Chapter 2](#).



## Appendix 3 Modifications to the Scottish Intercollegiate Guidelines Network checklist for systematic reviews and meta-analyses

TABLE 25 Modifications to the SIGN checklist for systematic reviews and meta-analyses

Checklist item	Original guidance <sup>33</sup>	Additional guidance and justification
1.1 Research question and inclusion/exclusion criteria	The PICO must be clear in the paper even if not directly referred to. The research question and inclusion criteria should be established before the review is conducted.	For the second sentence, we used a more forgiving guidance than AMSTAR-2: the authors must state that they have written a protocol or written a guide that included these elements or screening in general.
1.2 A comprehensive literature search is carried out.	At least two relevant electronic sources must be searched. The report must list the databases used (e.g. Central, EMBASE, and MEDLINE). (Cochrane register/Central counts as two sources; a grey literature search counts as supplementary). (PubMed and MEDLINE count as one database.) Key words and/or MESH terms must be stated and where feasible the search strategy should be provided. Dates for the search should be provided.  <b>The paragraph above is the minimum requirement.</b> All searches should be supplemented by consulting current contents, reviews, textbooks, specialised registers, or/and experts in the particular field of study, and by reviewing the references in the studies found.  <b>The paragraph above is a quality criterion, which affects the overall rating of the review.</b> <b>Notes</b> This criterion will not apply in the case of prospective meta-analysis – this is where meta-analysis is based on pre-selected studies identified for inclusion before the results of those studies are known. Such reports must state that they are prospective.	Just to make it clear, publications not reporting keywords or MESH terms got a 'No'.
1.3 At least two people should have selected studies.	At least two people should select papers. There should be a consensus process to resolve any differences.	Specifications added in red: At least two people should <u>independently select papers or a sample together, for both title/abstract and full texts.</u> There should be a consensus process to resolve any differences. <u>Publications not reporting such information got a 'No'. Those for which it is unclear for one of the two screening stages were marked as 'unclear'.</u>
1.4 At least two people should have extracted data.	At least two people should extract data and should report that a consensus was agreed. One person checking the others' data extraction is accurate is acceptable.	Specifications added in red: <b>At least two people should extract data <u>independently or on a sample together</u> and should report that a consensus was agreed. One person checking the others' data extraction is accurate is acceptable.</b> <u>The option 'unclear' was added.</u>

continued

TABLE 25 Modifications to the SIGN checklist for systematic reviews and meta-analyses (continued)

Checklist item	Original guidance <sup>33</sup>	Additional guidance and justification
1.5 The status of publication was not used as an inclusion criterion.	The authors should state that they searched for reports regardless of their publication status. The authors should state whether or not they excluded any reports (from the systematic review), based on their publication status. If review indicates that there was a search for 'grey literature' or 'unpublished literature', indicate 'yes'. SIGLE database, dissertations, conference proceedings and trial registries are all considered grey for this purpose. If searching a source that contains both grey and non-grey, must specify that they were searching for grey/unpublished lit.	Publications not reporting such information got a 'Yes'. This is because although they have not searched for it, there is no reason to believe that they have excluded those that they have come across because it is grey literature.
1.6 The excluded studies are listed.	Limiting the excluded studies to references is acceptable.	In line with the Cochrane Handbook, this was applied for the full texts (not titles and abstracts), and authors could list only those that are 'most likely to be considered eligible by readers' [12] (and not necessarily the whole list of excluded studies).
1.7 The relevant characteristics of the included studies are provided.	In an aggregated form such as a table, data from the original studies should be provided on the participants, interventions and outcomes. The ranges of characteristics in all the included studies, for example age, race, sex, relevant socio-economic data, disease status, duration, severity, or other diseases should be reported. (Note that a format other than a table is acceptable, as long as the information noted here is provided.) Absence of this will make it impossible to form guideline recommendations. <b>Mark as (-) original papers would need to be examined.</b>	To apply on the eligible results sections only Just to be clear, 'mark as (-)' means max low quality. In line with the Cochrane Handbook [12], other characteristics that had to be documented included the study design and the comparator (where relevant).
1.8 The scientific quality of the included studies was assessed and documented.	It can include use of a quality scoring tool or checklist, for example risk-of-bias assessment, or a description of quality items, with some kind of result for EACH study ('low' or 'high' is fine, as long as it is clear which studies scored 'low' and which scored 'high'; a summary score/range for all studies is not acceptable). Absence of this will make it impossible to form guideline recommendations. <b>Mark as (-).</b>	N/A since absence of quality or risk-of-bias appraisal and or results reported for each study was an exclusion criterion (i.e. reviews had to include these to be considered as evidence syntheses).
1.9 Was the scientific quality of the included studies used appropriately?	Examples include sensitivity analysis based on study quality, exclusion of poor-quality studies, and statements such as 'the results should be interpreted with caution due to poor quality of included studies'. The results of the methodological rigour and scientific quality should be considered in the analysis and the conclusions of the review, and explicitly stated in formulating recommendations.	Must meet A AND B to pass this criterion <b>A) In the synthesis (eligible results sections only)</b> (a) The quality is incorporated within the synthesis and not just presented as a separate block. This can be narratively or by conducting a subgroup analysis with some quality categories only. Mention of general results for sensitivity analyses (i.e. not the specific results) is sufficient to pass this criterion. (b) We are aware of two reasons for authors not to consider study quality or risk of bias in their synthesis. These need to be clearly stated by the authors and not just interpreted by the reviewers: <ul style="list-style-type: none"> <li>• The quality or risk of bias is similar across all studies.</li> <li>• The direction of effect is similar across studies.</li> </ul>

TABLE 25 Modifications to the SIGN checklist for systematic reviews and meta-analyses (continued)

Checklist item	Original guidance <sup>33</sup>	Additional guidance and justification
	Cannot score 'yes' for this question if scored 'no' for question 1.8.	B) In the conclusion/recommendations When quality is not mentioned, check if the results mentioned in the recommendations and conclusions rely overall on good-quality evidence. If they don't (e.g. evidence is rather weak or quality varies a lot), it should be mentioned, and this criterion is therefore failed.
1.10 Appropriate methods are used to combine the individual study findings.	<p>Studies that are very clinically heterogeneous should not be combined in a meta-analysis. Look at the forest plot – do the results look similar across the studies?</p> <p>For the pooled result a test should be done to assess statistical heterogeneity, i.e. chi-squared (<math>\chi^2</math>) test for homogeneity and/or I<sup>2</sup> test for inconsistency.</p> <p>If significant heterogeneity is apparent the authors should have explored possible explanations using methods such as sensitivity analysis or meta-regression. A random effects analysis may be used to take account of between-study variation but is not a 'fix' for heterogeneity. Planned subgroup analyses should be pre-specified and limited in number because conducting many subgroup analyses increases the probability of obtaining a statistically significant result by chance. Conclusions based on post hoc subgroup analyses must be interpreted with caution.</p> <p>Cannot score 'yes' for this question if scored 'no' for question 1.8.</p>	<p>To apply on the eligible results sections only</p> <p>Were also given a 'No' when:</p> <ul style="list-style-type: none"> <li>• Syntheses consisting of only describing each study one after the other (i.e. they are not combined).</li> <li>• When results vary within a category, the authors do not explore potential reasons for variation to make the results useful, for example by statistical significance, direction of effect, outcome (e.g. they just say X studies said it worked, X studies said it doesn't).</li> </ul>
1.11 The likelihood of publication bias was assessed appropriate	<p>The possibility of publication bias should be assessed where possible, commonly done by visual inspection of a funnel plot together with a statistical test for asymmetry (e.g. Egger regression test) although other statistical and modelling approaches may be reported.</p> <p>Absence of a funnel plot doesn't mean the likelihood of publication bias was not assessed appropriately (there are other methods); 10 studies is just a ball-park minimum number for a funnel plot and a plot is of little use when there are few studies.</p>	<p>To apply on the eligible results sections only</p> <p>'Not applicable' when there is no meta-analysis.</p>
1.12 Conflicts of interest are declared.	Potential sources of support should be clearly acknowledged in both the systematic review and the included studies.	<p>Like in AMSTAR-2, we split this question in two so that more nuanced answers could be given:</p> <p>1.12a. There is a declaration of competing interests or sources of support for the evidence synthesis.</p> <p>1.12b. Competing interests are reporting for the included studies (to apply on the eligible results sections only).</p>

continued

TABLE 25 Modifications to the SIGN checklist for systematic reviews and meta-analyses (continued)

Checklist item	Original guidance <sup>33</sup>	Additional guidance and justification
<b>Overall rating</b>		
High quality (++)	Majority of criteria met. Little or no risk of bias.	
Acceptable (+)	Most criteria met. Some flaws in the study with an associated risk of bias.	<p>Maximum rating when have obtained a 'No' for:</p> <ul style="list-style-type: none"> <li>- 1.9 (consideration of study quality in synthesis and conclusion).</li> <li>- 1.10 (synthesis methods).</li> <li>- Have obtained a 'No' for at least two of the four following key steps/elements: 1.1 PICO and protocol, 1.2 search, 1.3 screening, 1.4 data extraction.</li> </ul>
Low quality (-)	<p>Either most criteria not met, or significant flaws relating to key aspects of study design.</p> <p><i>(According to guidance for the specific items):</i> Maximum rating when have obtained a 'No' for either:</p> <ul style="list-style-type: none"> <li>• 1.7 (description of study characteristics – i.e. they are unclear, incomplete, or absent, making it difficult to understand what was assessed and how), OR</li> <li>• 1.8 (no quality assessment performed, or no result provided for each study, which is a key component of evidence syntheses).</li> </ul>	<p>The 'Low' and 'Unacceptable/reject' categories were merged. Apply when:</p> <ul style="list-style-type: none"> <li>• Have obtained a 'No' for 1.7 (description of study characteristics is unclear, incomplete, or absent, making it difficult to understand what was assessed and how), OR</li> <li>• Did not have a clear data extraction or synthesis (i.e. the way the authors have obtained their results is nebulous), OR</li> <li>• Have obtained a 'No' for both 1.9 and 1.10.</li> </ul>

## Appendix 4 Modifications to the Newcastle–Ottawa Scale for cross-sectional studies

TABLE 26 Modifications to the Newcastle–Ottawa Scale for cross-sectional studies

Categories and items	Original tool for cross-sectional studies <sup>21</sup>	Adapted tool for this project (modifications in red)
<b>Selection</b>		
1. Representativeness of the sample	<p>a. Truly representative of the average in the target population.* (* = 1 point) (all subjects or random sampling)</p> <p>b. Somewhat representative of the average in the target group.* (non-random sampling)</p> <p>c. Selected group of users/convenience sample.</p> <p>d. No description of the derivation of the included subjects.</p>	<p>a. Truly representative of the average in the target population (all subjects or random sampling) (<b>high quality</b>)</p> <p>b. Somewhat representative of <b>the most common units, for example the most popular TV channels</b>, in the target group. (non-random sampling;) (<b>moderate quality</b>)</p> <p>c. Selected group of users/convenience sample. (<b>low quality</b>)</p> <p>d. No description of the derivation of the included subjects. (<b>no info/unclear</b>)</p> <p><b>Document analyses: we considered instead the literature search (how comprehensive and clear it was)</b></p>
2. Sample size	<p>a. Justified and satisfactory (including sample size calculation).*</p> <p>b. Not justified.</p> <p>c. No information provided.</p>	<p>a. Justified <b>in a</b> satisfactory manner (including sample size calculation).(<b>high quality</b>)</p> <p>b. No <b>appropriate</b> justification. (<b>moderate or low quality; case by case</b>)</p> <p>c. No information provided (<b>no info/unclear</b>)</p> <p><b>Document analyses: we considered instead the variety of information sources used, taking into account the study aim.</b></p>
3. Non-respondents/missing data	<p>a. Proportion of target sample recruited attains pre-specified target or basic summary of non-respondent characteristics in sampling frame recorded.*</p> <p>b. Unsatisfactory recruitment rate, no summary data on non-respondents.</p> <p>c. No information provided.</p>	<p><b>Non-respondents: identical for studies involving human participants or human-based data. Ignored for non-human studies and document analyses. Missing data: new options for all study designs.</b></p> <p>Proportion of target sample recruited attains pre-specified target or basic summary of non-respondent characteristics in sampling frame recorded. (<b>high quality</b>)</p> <p>a. Unsatisfactory recruitment rate, no summary data on non-respondents. (<b>low quality</b>)</p> <p>b. No information provided (<b>no info/unclear</b>)</p> <p>c. <b>Methods to deal with missing data explained and appropriate. (high quality)</b></p> <p>d. <b>Methods to deal with missing data unclear or inappropriate. (moderate or low quality; case by case)</b></p>
4. Ascertainment of the exposure (risk factor)	<p>a. Vaccine records/vaccine registry/clinic registers/hospital records only.** (** = 2 points)</p> <p>b. Parental or personal recall and vaccine/hospital records.*</p> <p>c. Parental/personal recall only.</p>	<p>a. No obvious reason to believe that they did not use an up-to-date list of participants or that participant status changed during the evaluation period and was not accounted for, using info in the paper and policy in general. (<b>high quality</b>)</p>

continued

TABLE 26 Modifications to the Newcastle–Ottawa Scale for cross-sectional studies (continued)

Categories and items	Original tool for cross-sectional studies <sup>21</sup>	Adapted tool for this project (modifications in red)
		b. Reasons to believe that the list of participants was not up to date or that membership is likely to have changed during the evaluation period and was not considered in the evaluation, using info in the paper and policy in general. <b>(low quality)</b> c. No information provided. (no info/unclear) <b>Not applicable to document analyses</b>
<b>Comparability</b>		
5. Comparability of subjects in different outcome groups on the basis of design or analysis. Confounding factors controlled.	a. Data/results adjusted for relevant predictors/risk factors/confounders for example age, sex, time since vaccination, etc.** b. Data/results not adjusted for all relevant confounders/risk factors/information not provided.	a. Data/results adjusted for relevant predictors/risk factors/confounders. <b>(high quality)</b> b. Data/results not adjusted for all relevant confounders/risk factors/information not provided. <b>(moderate or low quality; case by case)</b>  <b>Not applicable to document analyses. In practice, this was also difficult to assess in the other studies because the 'participants' (or unit of analysis) were non-humans and typical confounders are related to human characteristics. The factors that we could identify relating to the environment mostly related to external validity (e.g. time of the year/day of data collection) rather than internal validity.</b>
<b>Outcome</b>		
6. Assessment of outcome	a. Independent blind assessment using objective validated laboratory methods.** b. Unblinded assessment using objective validated laboratory methods.** c. Used non-standard or non-validated laboratory methods with gold standard.* d. No description/non-standard laboratory methods used.	a. Blinded AND Double/Single independent assessment using methods appropriate for study aim. <b>(high quality)</b> b. Unblinded double/single data (database). <b>(high quality)</b> c. Unblinded double data (collected on the field). <b>(moderate quality)</b> d. Unblinded AND Single using methods appropriate for study aim or unclear. <b>(low quality)</b>
7. Statistical test	a. Statistical test used to analyse the data clearly described, appropriate and measures of association presented including CIs and probability level ( <i>p</i> value).* b. Statistical test not appropriate, not described or incomplete.	a. Statistical test used to analyse the data clearly described, appropriate and measures of association presented including CIs and probability level ( <i>p</i> value).* <b>(high quality)</b> b. Statistical test not appropriate, not described or incomplete. <b>(low quality)</b> c. Statistical test not appropriate, not described or incomplete. (no info/unclear)  <b>For document analyses, 'statistical test' is replaced by 'analytical methods', and information about precision estimates was ignored.</b>
<b>Overall rating</b>		
	* = 1 point ** = 2 points <b>Very Good Studies:</b> 9–10 points <b>Good Studies:</b> 7–8 points <b>Satisfactory Studies:</b> 5–6 points <b>Unsatisfactory Studies:</b> 0–4 points	<b>New classification:</b> two key items: 4. ascertainment of exposure and 7. statistical tests <b>High quality:</b> Items 4 or 7 rated high, few other items rated moderate, no item rated low



TABLE 26 Modifications to the Newcastle–Ottawa Scale for cross-sectional studies (continued)

Categories and items	Original tool for cross-sectional studies <sup>21</sup>	Adapted tool for this project (modifications in red)
		<p><b>Moderate quality:</b></p> <ul style="list-style-type: none"> <li>items 4 or 7 rated moderate, and none rated low</li> <li>judgement based on the other item ratings</li> </ul> <p><b>Low quality:</b> when 1 + item is rated low</p> <p><b>Unclear quality:</b></p> <ul style="list-style-type: none"> <li>items 4 or 7 rated unclear, and none rated low</li> <li>2 + items rated unclear, and none rated low</li> </ul>



## Appendix 5 Additional tables for *Chapter 4* (overview of reviews)

**TABLE 27** Primary study overlap in the reviews assessed for inclusion in the overview of reviews (n = 15)

<b>Review unique studies</b>	<b>Lhachimi 2020</b>	<b>Pfinder 2020</b>	<b>Dodd 2020</b>	<b>Crocker 2020</b>	<b>Teng 2019</b>	<b>von Phillipsborn 2019</b>	<b>Hyseni 2017a (trans-fats)</b>	<b>Hillier- Brown 2017</b>	<b>Backholer 2016</b>	<b>Redondo et 2018</b>	<b>Downs 2017</b>	<b>Sisnowski et 2017</b>	<b>Alagiyawana 2015</b>	<b>Rincon- Gallardo 2020</b>	<b>Hyseni 2017b (salt)</b>	<b>N times a study overlaps</b>
Aguilar A, 2017					x											
Andalón M, 2017					x											
Angell SY, 2012											x					
Angell SY, 2009											x					
Araya S, 2018				x												
Arcand J, 2014											x					
Berardi N, 2012												x				
Biró A, 2015		x										x				1
Blake MR, 2018						x										
Bleich SN, 2015														x		
Bleich SN, 2016														x		
Bleich SN, 2017														x		
Bleich SN, 2018														x		
Bleich SN, 2020														x		
Blumberg FB, 2014							x									
Brandt EJ, 2015											x					
Breeze P, 2018							x									
Bruemmer B, 2012														x		
Bødker M, 2015	x											x				1
Capacci S, 2018					x											
Colantuoni F, 2015					x					x						1

Review unique studies	Lhachimi 2020	Pfnder 2020	Dodd 2020	Crocker 2020	Teng 2019	von Philipborn 2019	Hyseni 2017a (trans-fats)	Hillier- Brown 2017	Backholer 2016	Redondo et 2018	Downs 2017	Sisnowski et 2017	Alagiyawana 2015	Rincon- Gallardo 2020	Hyseni 2017b (salt)	N times a study overlaps
Colchero MA, Guerrero-López CM, et al., 2016					x					x						1
Colchero MA, Popkin BM, et al., 2016										x						
Colchero MA, Molina M, et al, 2017					x											
Colchero MA, Rivera-Dommarco J, et al., 2017					x											
Colon-Ramos U, 2006											x					
Cornelsen L, 2017							x									
Elshiewy O, 2018				x												
Enkhtungalag, 2015															x	
European Competitiveness and Sustainable Industrial Policy Consortium, 2014					x											
Fabiansson SU, 2006												x				
Falbe J, 2016					x					x						1
Fattore, 2014															x	
Fletcher JM, Frisvold D and Tefft N. Can soft drink ... , 2010.									x				x			1
																continued



Review <i>unique studies</i>	Lhachimi 2020	Pfnder 2020	Dodd 2020	Crocker 2020	Teng 2019	von Phillipsborn 2019	Hyseni 2017a (trans-fats)	Hillier- Brown 2017	Backholer 2016	Redondo et 2018	Downs 2017	Sisnowski et 2017	Alagiyawana 2015	Rincon- Gallardo 2020	Hyseni 2017b (salt)	N times a study overlaps
Mohan, 2009															x	
Monge-Rojas R, 2013							x				x					1
Monge-Rojas R, 2011											x					
Mozaffarian D, 2010											x					
Mozaffarian D, 2009							x									
Mozaffarian D, 2012															x	
Nakamura R, 2018					x											
Namba A, 2013														x		
Ng SW, 2014						x										
Pacific Research Centre for the Prevention of Obesity and NCDs (CPOND), 2017			x													
Penaherrera V, 2018				x												
Petimar J, 2019														x		
Peymani P, 2012											x					
Pietinen, 2010															x	
Powell LM, 2009									x				x			1
Pulos E, 2010								x								

continued





<i>Review unique studies</i>	Lhachimi 2020	Pfnder 2020	Dodd 2020	Crocker 2020	Teng 2019	von Philipsborn 2019	Hyseni 2017a (trans-fats)	Hillier-Brown 2017	Backholer 2016	Redondo et 2018	Downs 2017	Sisnowski et 2017	Alagiyawana 2015	Rincon-Gallardo 2020	Hyseni 2017b (salt)	N times a study overlaps
Van Camp D, 2012											x					
Vesper HW, 2012							x				x					1
Vesper HW, 2017											x					
Wang, 2011															x	
Wang, 2013															x	
Wansink B, 2014								x								
Webster, 2011															x	
Wellard-Cole L, 2018														x		
Wellard-Cole L., 2019														x		
World Bank, 2019			x													
WHO Regional Office for Europe, 2015			x													
Wu HW, 2014														x		
Wyness, 2012															x	
Zhong Y, 2018					x											
<i>N studies in the eligible sections of the reviews</i>	2	1	4	3	17	8	7	2	3	5	23	6	6	15	15	Of 98 unique studies: 17 overlap once, 1 twice
<i>N (%) studies that overlap with another</i>	2 (100%)	1 (100%)	0 (0%)	0 (0%)	7 (41%)	0 (0%)	6 (86%)	0 (0%)	3 (100%)	4 (80%)	6 (26%)	3 (50%)	5 (83%)	0 (0%)	0 (0%)	

continued

**TABLE 27** Primary study overlap in the reviews assessed for inclusion in the overview of reviews (n = 15) (continued)

Review unique studies	Lhachimi 2020	Pfinder 2020	Dodd 2020	Crocker 2020	Teng 2019	von Philipsborn 2019	Hyseni 2017a (trans-fats)	Hillier- Brown 2017	Backholer 2016	Redondo et 2018	Downs 2017	Sisnowski et 2017	Alagiyawana 2015	Rincon- Gallardo 2020	Hyseni 2017b (salt)	N times a study overlaps
Review(s) it overlaps with ... :	Sisnowski	Sisnowski	-	-	Backholer, Redondo, Alagiyawana	-	Downs	-	Teng, Alagiyawana	Teng	Hyseni a	Pfinder, Lhachimi	Backholer, Teng	-	-	Of 15 reviews, 9 have study overlaps
Decision to reduce primary study overlap <sup>a</sup>	Include	Include	Include	Include	Include	Include	Exclude	Include	Exclude	Exclude	Include	Include BoP; Exclude taxes	Exclude	Include	Include	11 reviews are included fully or partially, 4 are fully excluded
N unique studies excluded fully from the OOR	-	-	-	-	-	-	1	-	2	1	-	1	1	-	-	Of 98 initial studies, 6 are excluded

BoP, back-of-pack labelling; OOR, overview of reviews.

a See [Table 28](#) 'Screening decisions to reduce primary study overlap' for more details.

#### Notes

Colours at the top of the table: in pale orange = studies that overlap once, in dark orange = studies that overlap twice, in blue = studies excluded to reduce primary study overlap and that are not included in the OOR at all.

Colours at the bottom of the table: in green = included in the OOR; in grey = excluded from the OOR; in yellow = included partly in the OOR.

**TABLE 28** Screening decisions to reduce primary study overlap in the overview of reviews (n = 15)

Author, year	Search	Decision	Justification for selecting a review	Quality
<b>Overlapping group 1 (both on trans-fat policies)</b>				
Downs (2017) <sup>48</sup>	August 2017	<b>Include</b>	Both have the same search date and compared regulatory and voluntary policies. Although Downs have a lesser quality, it was still acceptable and it assessed a wider range of outcomes, included more studies (23 compared to 7 in Hyseni), covered more countries (Brazil, Iran, Korea, Mexico, the Netherlands, Americas in addition to those included in Hyseni), and included 6 of the 7 publications included in Hyseni.	Acceptable (+)
Hyseni (2017a) <sup>38</sup>	August 2017	<b>Exclude</b>		High (++)
<b>Overlapping group 2 (on back-of-pack labelling and various taxes)</b>				
Lhachimi (2020) <sup>42</sup>	October 2019	<b>Include</b>	Sisnowski: <b>include</b> the results section on back-of-pack labelling (Australia, n = 1) since this is the only one in this group. <b>Exclude</b> the results section on taxes since it covers multiple types of taxes together (fat, non-essential foods, SSBs). The assessment is not as specific as (which focuses on sugar and SSB taxes), and Lhachimi (which focuses on the saturated fat). Keep both Pfinder and Lhachimi since they do not overlap, are of high quality (Cochrane reports), and cover different topics.	High (++)
Pfinder (2020) <sup>44</sup>	October 2019	<b>Include</b>		High (++)
Sisnowski (2017) <sup>39</sup>	October 2015	<b>Include partly</b>		Acceptable (+)
<b>Overlapping group 3 (on SSB taxes)</b>				
Teng (2019) <sup>45</sup>	June 2018	<b>Include</b>	Keep Teng because it has a high quality, is the most recent, includes more recent studies, includes more papers (n = 18), and is the only one that includes other countries than the USA (Chile, Finland, France, Hungary, Mexico, Spain). Backholer also has a high quality but has an older search and includes fewer studies (n = 3), of which one is in Teng. Alagiyawanna is of lesser quality, has an older search and fewer studies than Teng (n = 6), of which five are in Teng. Redondo is also of lesser quality, also has an older search, and fewer studies than Teng (n = 5), of which four are in Teng.	High (++)
Backholer (2016) <sup>35</sup>	June 2015	<b>Exclude</b>		High (++)
Alagiyawanna (2015) <sup>36</sup>	July 2013	<b>Exclude</b>		Acceptable (+)
Redondo (2018) <sup>37</sup>	December 2017	<b>Exclude</b>		Acceptable (+)

TABLE 29 Characteristics of studies excluded to reduce primary study overlap

First author (year)	Section(s) of synthesis considered	N studies Type of synthesis	Countries	Categories of eligible policies	Types of outcomes measured	Funding sources reported	Declaration of competing interests
Backholer (2016) <sup>35</sup> High (++)	<b>Would have been included otherwise</b> Studies evaluating existing SSB taxes <b>Would have remained excluded</b> Studies where the primary result was estimated price elasticities, modelling studies, amount paid in SSB tax according to socioeconomic position following an increase in SSB price	N = 3 (out of 11) Narrative	USA	U-SSB tax	Health (BMI); Consumer behaviour (dietary intake) <sup>a</sup>	Non-industry funding	None declared
Hyseni (2017a) <sup>38</sup> High (++)	<b>Would have been included otherwise</b> Empirical studies: food reformulation, and multicomponent interventions <b>Would have remained excluded</b> (1) Empirical studies: individual dietary counselling, worksite dietary counselling, legislation (local); (2) modelling studies	N = 8 (out of 23) Narrative	CAN, CR, DEN, USA, N America and Europe	N-Trans-fat labelling; I-Trans-fat reformulation/limits/ban S-Retail and food services (trans-fat reformulation/limits/ban)	Health (heart diseases, trans-fat concentration in human body); consumer behaviour (dietary intake, purchases); food environment (nutritional composition)	NR	None declared
Alagiyawanna (2015) <sup>36</sup> Acceptable (+)	<b>Would have been included otherwise</b> Studies on food and beverage taxation in HIC: effects on anthropometry, and consumption and anthropometry <b>Would have remained excluded</b> Studies on food and beverage taxation in HIC: effects on consumption (subsidies); studies on food and beverage subsidies in HICs (PRO, effects on health outcomes related to diet and anthropometry); studies about LMICs (all about subsidies)	N = 6 (out of 18) Narrative	USA	U-Tax on SSBs, snacks and fast-food restaurants	Health (BMI, obesity); consumer behaviour (dietary intake) <sup>a</sup>	No funding	None declared
Redondo (2018) <sup>37</sup> Acceptable (+)	<b>Would have been included otherwise</b> Naturalistic experiments <b>Would have remained excluded</b> Virtual or experimental conditions	N = 5 (out of 17) Narrative	MEX, USA	U-SSB tax	Consumer behaviour (sales/purchases); food envt (price); economy (store revenue)	Non-industry funding	None declared
Sisnowski (2017) <sup>39</sup> Acceptable (+)	<b>*REVIEW PARTLY EXCLUDED*</b> <b>Section specifically excluded to reduce primary study overlap</b> Taxation of unhealthy foods and beverages	N = 5 (out of 17) Narrative	DEN, FRA, HUN	U-Taxes on SSB, saturated fat, non-essential foods	Health (BMI, heart diseases); consumer behaviour (dietary intake, purchases/sales); food envt (nutrition composition, price)	Non-industry funding	None declared

Envt, environment; NR, not reported.

<sup>a</sup> Table of results says purchases, but the results section focuses on dietary intake.

**TABLE 30** Quality appraisal of systematic reviews fully excluded because of primary study overlap (n = 5)

Lead author (year)	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	1.11	1.12a	1.12b	Overall rating
Alagiyawanna (2015) <sup>36</sup>	No	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	N/A	Yes	No	Acceptable (+)
Backholer (2016) <sup>35</sup>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	N/A	Yes	No	High (++)
Hyseni (2017a) <sup>50</sup>	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	N/A	Yes	No	High (++)
Redondo (2018) <sup>37</sup>	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	N/A	Yes	No	Acceptable (+)

**Notes**

Source: quality assessment tool used: SIGN. Legend: **1.1** Is the research question clearly defined and the inclusion/exclusion criteria listed in the paper? **1.2** A comprehensive literature search is carried out; **1.3** At least two people should have selected studies; **1.4** At least two people should have extracted data; **1.5** The status of publication was not used as an inclusion criterion; **1.6** The excluded studies are listed; **1.7** The relevant characteristics of the included studies are provided; **1.8** The scientific quality of the included studies was assessed and reported; **1.9** Was the scientific quality of the included studies used appropriately? **1.10** Appropriate methods are used to combine the individual study findings; **1.11** The likelihood of publication bias was assessed appropriately; **1.12a** Conflicts of/competing interests (Col) are declared for the SR; **1.12b** Col are reported for the included studies. Overall quality ratings: (+) acceptable, (-) low, (++) high quality, (?) unclear.



## Appendix 6 Additional literature searches for Chapter 7 (cost-effectiveness analysis)

TABLE 31 Additional literature searches for the systematic review on cost-effectiveness: FOPL

Search in: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review and Other Non-Indexed Citations and Daily <1946–22 September 2021>	
Search lines	N
1. food packaging.mp. or exp food packaging/	11,208
2. food labelling.mp. or exp Food Labeling/	4315
3. 1 or 2	11,371
4. nutritive value.mp. or exp Nutritive Value/	19,684
5. 3 and 4	939
6. (label* or content* sign* or symbol or symbols or ticket* or sticker* or logo* or diet* or health* or calori* or nutri* or 'daily amount*' or 'recommended daily amount*' or 'reference value*' or 'reference intake*' or 'daily value*' or 'reference nutrient intake*' or 'nutritive value').ti,ab.	4,366,351
7. 1 and 6	4722
8. (((product adj2 label*) and food*) or 'front of pack*' or 'food label*' or ((prepack* adj1 food*) and label*) or (('pre-pack*' adj1 food*) and label*) or (('pre pack*' adj1 food*) and label*)),ab,ti.	2392
9. (food adj1 pack*).ab,ti.	3700
10. (food* or fat* or sugar* or salt or sodium or diet* or health* or calori* or nutritio* or 'daily amount*' or 'recommended daily amount*' or 'reference value*' or 'reference intake*' or 'daily value*' or 'reference nutrient intake*' or snack* or eat*).ti,ab.	5,222,426
11. product labelling.mp. or exp Product Labeling/	2927
12. 10 and 11	1224
13. exp Food Labeling/	4150
14. ((Nutriti* or Nutrient*) adj5 (label* or content* sign* or symbol or symbols or ticket* or sticker* or warning* or vignette* or logos)).ab,ti.	1742
15. ((nutrition* information or nutrient* information) and (pack* or label* or prepack* or 'pre pack*' or content* sign* or symbol or symbols or tag* or ticket* or sticker* or vignette* or logo*)).ti,ab.	504
16. (Food* label* or food* content* label* or food* content* sign* or food* content symbol* or food* content* tag* or food* content* ticket* or food* content* sticker* or food* content* logo*).ab,ti.	1424
17. ((warning adj2 octagon*) or 'octagonal black system*' or WOBS or 'ley de etiquetado de alimentos' or 'ley de alimentos' or (Law adj2 '20.606') or 'Super 8' or 'Nutri-score*' or 'Nutri score*' or 'Nutriscore*' or 'Health star*' or (HSR adj3 system*) or ('traffic light*' and (label* or food* or nutri* or diet* or pack*)) or ('Warning label*' and (food* or nutri* or diet*))).ab,ti.	971
18. ((keyhole or 'key hole') adj5 (Nordic* or label* or sign* or symbol* or vignette*)).ab,ti. 105	
19. (N?kkelhullet or N?glehullet or Nyckelh?let or 'ley del S?per Ocho' or 'Ley S?per 8').ab,ti.	1
20. (('guideline daily amount*' or 'nutrient reference*' or 'reference intake*' or 'nutrient intake*' or 'daily value*' or 'daily val-ue*') adj5 (label* or content* sign* or symbol or symbols or ticket* or sticker* or vignette* or logo*)).ab,ti.	82
21. (recommended dietary allowance* adj5 (label* or content* sign* or symbol or symbols or ticket* or sticker* or vignette* or logo*)).ab,ti.	1
22. ((Calorific or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy) adj5 (label* or content* sign* or symbol or symbols or ticket* or sticker* or vignette* or logo*)).ab,ti.	1681

continued

**TABLE 31** Additional literature searches for the systematic review on cost-effectiveness: front-of-pack labelling (continued)

<b>Search in: Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review and Other Non-Indexed Citations and Daily &lt;1946–22 September 2021&gt;</b>	
<b>Search lines</b>	<b>N</b>
23. (((Caloric or calorie* or caloric or kilojoule* or kilocalorie* or kcal* or kJ* or energy) adj information) and (pack* or label* or prepack* or 'pre-pack*' or 'pre pack*')).ab,ti.	108
24. ((fat or fats or fatty) adj3 (label* or content* sign* or symbol or symbols or ticket* or sticker* or vignette* or logo*)).ab,ti.	2039
25. ((fat or fats or fatty) adj3 (label* or symbol or symbols or ticket* or sticker* or vignette* or logo*)).ab,ti.	1990
26. 24 not 25	49
27. ((salt or sodium) adj3 (label* or symbol or symbols or tag* or ticket* or sticker* or vignette* or logo*)).ab,ti.	1066
28. (sugar* adj3 (label* or symbol or symbols or tag* or ticket* or sticker* or vignette* or logo*)).ab,ti.	694
29. (sugar* adj3 (label* or content* sign* or symbol or symbols or tag* or ticket* or sticker* or vignette* or logo*)).ab,ti.	705
30. ((Label* adj2 (legislation* or regulation* or policies or policy or law or laws)) and (food* or diet* or nutri*)).ti,ab.	455
31. ('food law' and (label* or pack* or 'pre-pack*' or 'pre pack*')).ab,ti.	16
32. (drink or drinks or beverage or beverages or soda or sodas or 'flavored water*' or 'flavoured water*' or 'fruit water*' or cordial or cordials or squash or squashes or juice* or smoothie* or milkshake* or tea or teas or coffee*).ab,ti.	136,203
33. 11 and 32	109
34. ((drink* or beverage*) adj2 (label or labelling or labelling or labels)).ab,ti.	82
35. ((soda or sodas or 'flavored water*' or 'flavoured water*' or 'fruit water*' or cordial or cordials or squash or squashes or juice or juices or smoothie* or milkshake* or tea or teas or coffee*) adj2 (label or labelling or labelling or labels)).ab,ti.	12
36. 5 or 7 or 8 or 9 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 25 or 27 or 29 or 30 or 31 or 33 or 34 or 35	17,027
37. limit 36 to yr='2010 - 2020' 8712	
38. Cost-Benefit Analysis/ or cost-effect*.mp. 193257	
39. cost-benefits.mp. 1034	
40. (economic and (evaluation or impacts)).mp. [mp = title, abstract, original title, name of substance word, subject heading word, floating subheading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	43,545
41. costs.mp. or exp 'Costs and Cost Analysis'/	398,973
42. 38 or 39 or 40 or 41	515,489
43. 37 and 42	320



TABLE 32 Additional literature searches for the systematic review on cost-effectiveness: salt, sugar and fat reformulation

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review and Other Non-Indexed Citations and Daily <1946–22 September 2021>	
Search lines	N
1. (Policy or policies or Plan or plans or Strategy or strategies or Standard or standards or Scheme* or Program* or Guide or guides or guidance or guidelines or Code or codes or restrict*).mp. [mp = title, abstract, original title, name of substance word, subject heading word, floating subheading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	5,225,242
2. (reformulat* or target or targets or reduction or limit or limits or prohibit*).mp. [mp = title, abstract, original title, name of substance word, subject heading word, floating subheading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	2,894,771
3. (ban or bans or banned).mp. [mp = title, abstract, original title, name of substance word, subject heading word, floating subheading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	14,739
4. (Salt or Sodium or Sugar* or Fat or fats or fatty acids).mp. [mp = title, abstract, original title, name of substance word, subject heading word, floating subheading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	1,286,215
5. ((Salt or Sodium or Sugar* or Fat or fats or fatty acids) adj3 (reformulat* or target or targets or reduction or limit or limits or prohibit*)).mp.	10,383
6. 5 and 1	3590
7. ((Salt or Sodium or Sugar* or Fat or fats or fatty acids) adj3 (ban or bans or banned)).mp.	75
8. exp Sodium, Dietary/	16,239
9. exp Sugars/	419,945
10. exp Fats/	106,891
11. 8 or 9 or 10	533,475
12. 1 and 2 and 11	14,447
13. exp Cost-Benefit Analysis/ or cost-effect*.mp.	193,257
14. cost-benefit*.mp.	93,907
15. (economic and (evaluation or impacts)).mp. [mp = title, abstract, original title, name of substance word, subject heading word, floating subheading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	43,545
16. costs.mp. or exp 'Costs and Cost Analysis'/	398,973
17. 13 or 14 or 15 or 16	519,845
18. 12 and 17	478
19. 6 or 7	3661
20. limit 19 to yr='2010 - 2020'	2096
21. 17 and 20	134





EME  
HSDR  
HTA  
PGfAR  
**PHR**

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