Best-ReMaP
Healthy Food for a Healthy Future

Will food marketing restrictions, food reformulation, or food procurement standards have an impact on health inequities?

A Best-ReMaP literature review, with guidance for undertaking detailed systematic reviews

Grant Agreement Number 951202

Tim Lobstein

26 / February / 2023

This **report** was funded by the European Union's Health Programme (2014-2020)

Contents

Summary…… 1

1. Introduction…… 6

2. Methods…….. 7

2.1. Type of review…… 7

2.2. Purpose……... 7

2.3. Searches…….. 9

3. Results……... 12

3.1. Literature review, and a proposed framework for equity impact assessment. 12

3.1.1. Background: assessing the potential for inequity in the health outcomes of diet-related health interventions…….. 12

3.1.2. Papers identifying potential criteria for health equity impact assessment 16

3.1.3. A composite framework for health equity impact assessment…… 22

3.2. Summary of literature on health inequalities in relation to food and beverage marketing restrictions……... 25

3.3. Summary of literature on health inequalities in relation to food and beverage reformulation…….. 33

3.4. Summary of literature on health inequalities in relation to food and beverage public procurement……... 40

4. Discussion: key elements for assessing best practice policies for their impact on health inequalities……... 48

References……. 54

Annex 1: Details of search terms used and selection PRISMA charts…… 74

Annex 2: Papers included in review (PRISMA ‘full text’)…… 82

Annex 3: Tools for undertaking a systematic review, or a review of systematic reviews…… 102

Content of tables and figures

Summary of evidence for the health equity impact of three policy interventions….. 2

Table 1.1. PICO statement for the literature search for health equity impact for food and nutrition policies…… 7

Table 1.2. PICO statement for the literature search in respect of three policy areas 8

Table 2.1. Abbreviated search terms for health equity impact criteria…….. 9

Table 2.2 Abbreviated search terms for three policy reviews…… 10

Table 3.1 RE-AIM definitions and equity questions…… 18

Table 3.2 Summary of WHO health equity outcomes…… 19

Table 3.3. Proposed framework for an equity impact assessment for diet-related health policies…… 22

Table 3.4. Summary table for evidence of health equity impact of restricting children's exposure to food marketing…….. 31

Table 3.5. Summary table for evidence of health equity impact of food reformulation…….... 37

Table 3.6. Summary table for evidence of health equity impact of food procurement…….. 46

Table 4.1 Summary of evidence for the health equity impact of three policy interventions……. 50

Figure 3.1. Proposed framework for the impact of obesity prevention strategies on socio-economic inequities in population weight status……..... 21

Summary

This document is a review of research and policy literature. Its purpose is to provide guidance to the Best-ReMaP Joint Action on the role of inequities in health policies, especially on the application of three policies (food marketing restrictions, food reformulation and food procurement) in respect of their effects on diet-related health. The approach used here is (a) to undertake a preliminary review of potential criteria which can be applied to the assessment of the equity of policies, and then (b) to use these criteria to evaluate the impact of the three policies on heath equity.

The first literature review established a framework consisting of four main concerns where inequities should to be considered (underlying risks, reach of an intervention, response, and sustainability of the response), and within each of these a series of specific issues that need to be addressed. A summary 'checklist' is given in Table 3.1 on pages 22-24.

Following this, three further literature reviews provide an assessment of the health equity impact of each of the three policies within the framework. The reviews look at the available evidence to help answer the 'checklist' questions for assessing the health equity impact of each policy. The results are summarised in the table on the next page.

Annexes provide details of the reviews undertaken, the search terms used and other resources to aid the further development of assessments of policies for their impact on diet-related health inequalities.

A more detailed 'Executive Summary' is provided in the form of a Discussion, on pages 48-49.

Summary of evidence for the health equity impact of three policy interventions

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
Pre-occurring risk	Underlying health or diet differences	Does one group eat a less healthy diet (e.g. more salt)? Would they benefit more from change?	Evidence of greatest need among lower SES children	Evidence of greatest need among lower SES groups	Evidence of greatest need among lower SES groups
	Vulnerability or susceptibility	Is one group more responsive to advertising? Or to price modification?	Some evidence of greater vulnerability in lower-SES children.	Price sensitivity may disadvantage lower-income households.	Price sensitivity and resistance to change may be higher in low SES groups.
	General exposure to potential hazard	Is one group more exposed to TV advertising?	Evidence of greater exposure in lower SES groups	Exposure is proportional to purchase across all groups	Exposure to poor food procurement may show a socio-economic gradient
	Targeted exposure to potential hazard	Is one group more dependent on social food provision? Is TV advertising targeted at sub-groups?	Evidence of targeting of lower-income or minority groups.	Targeted promotion may increase low SES exposure	No evidence of deliberate targeting of socio-economic subgroups.
Reach and type of policy or intervention	Reach across subgroups/gradient	Do public health initiatives reach all groups? Are there language issues?	Reach in proportion to exposure: universal and proportionate.	Mandatory reformulation likely to be universal and proportionate.	Limited evidence of reach across all groups: likely universal and proportionate.
	Degree of penetration within sub-groups	Within poorer groups, are homeless people reached? Or adolescents after leaving home?	No evidence found.	No evidence found.	Limited evidence that improved food standards reach all within subgroups.

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
	Localised (micro) or widespread (macro)	Is the policy local or national? Are reformulated foods available in all shops?	At both levels interventions would improve health equity	Macro, affecting all consumers of the specific products	Both: localised practices and national standards
	Is it upstream or downstream?	Does the policy target upstream (e.g. food companies) or downstream (consumers)?	Upstream: likely to improve health equity.	Upstream: Likely to improve health equity	Primarily upstream with potential to improve health equity
	Reach of supportive messaging	Do health messages in support of reformulation regulations reach all groups?	No evidence found.	Possibly greater reach in higher income groups	No evidence of differential reach of messaging
	Access to supportive services	Do welfare food vouchers reach all those in need?	No evidence found.	No evidence found	Potential differential access to supportive services
Response to intervention	Agency- or structure-led behaviour change	Does the policy require individual voluntary changes in behaviour? Is the healthier choice the easier choice?	Structure-led: likely to improve health equity	Mandatory reformulation is a structure-led intervention	Structure-led with some limited agency
	Resource requirements	Does behaviour change require financial, time or equipment resources? Are reformulated products more expensive?	No resource requirements for individuals. (Low costs to media platforms, potential savings to advertisers, low cost to public finances.)	Resource requirements if there are price differentials	Costs may act as a disincentive

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
	Skills, literacy and numeracy requirements	Does behaviour change require skills to implement? Do food labels need literacy or numeracy skills?	No personal skills, literacy or numeracy required.	Choice may require literacy or numeracy	No skills, literacy or numeracy is required
	School-to-home transfer of behaviour changes	Do school-based programmes to drink water or eat fruit transfer easily to the home environment?	No school-to-home transfer required	No school-to-home transfer required	Mixed evidence of school-home relations
	Household-level acceptability of intervention	Are behaviour changes suitable for all cultures? What about periods of fasting?	No evidence of differential acceptability.	Some resistance to reformulated products	Depends on cost and attractiveness, and parental involvement in adopting new standards
	Household-level perceived priority	Is the behaviour change competing with other priorities? Are all members of a household motivated?	No evidence of differential perceived priority.	No evidence of differential perceived priority	No evidence on whether food procurement is differentially prioritised
Sustainability of response	Compatibility with community and cultural environment	Are policies in concordance with existing dietary patterns and food supply environments? Are fast food outlets undermining a policy?	No evidence for differential compliance	No evidence of community incompatibility.	No clear evidence of differential compatibility
	Voluntary vs regulatory	Does the policy have statutory support? Can it be ignored in some areas, or reversed easily?	Regulatory implementation likely improves health equity	Mandatory reformulation maximises health equity improvement	Improved standards likely to be mandatory

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
	Barriers/threats to policy maintenance	What might undo the policy? Is this more likely in some communities or sub-groups?	Commercial resistance could widen health inequity.	Commercial interests may undermine equity benefits of reformulation	Price and attractiveness may affect sustainability
			Health equity increases, especially with strong regulatory implementation	**Health equity increases, especially with mandatory implementation**	**Health equity increases, especially with mandatory procurement standards**

1. Introduction

Increasingly, governments are following the lead of the World Health Organization, whose normative work, including its recommendations and guidelines, must integrate equity, human rights, gender and the social determinants of health – see *Handbook for Guideline Development, 2nd edition* (WHO 2014). The social determinants of health are described as *'the conditions in which people grow, live, work and age'* (ibid p47), and are often linked to income, educational status or neighbourhood deprivation. Furthermore, while health *inequalities* are differences in health status between population groups from all causes, health *inequities* are specifically *'differences in health that are unfair, avoidable and remediable because they depend largely on the social determinants of health, which are amenable to improvement*' (ibid p47).

While it is important to use data and research to highlight inequitable health outcomes in existing systems, there is a need to recognise these as indicators of injustice and of the transgenerational perpetuation of disadvantage and deprivation, and therefore take action to address the situation (Nisbett et al 2022). Equity should be considered in the development of any policy to improve health, taking account of the average health benefit *and* how the health benefit may be distributed within populations and across groups. People with less money, less education and poor living conditions are more likely to experience food insecurity and have a less healthful eating pattern and higher levels of diet-related diseases (Swinburn et al 2019, Msora-Kasago 2020). Health policies should aim to ensure that those with greater needs can benefit the most from the intended policy, thereby reducing health inequities, reducing overall health costs and ensuring a progressive realisation of the right to health for all.

In the case of the Best-ReMaP Joint Action, three health-related policy areas are examined in Work Packages 5, 6 and 7, concerning respectively (i) reducing the impact of harmful marketing of food to children; (ii) changing and regulating the food composition that can be offered on the market; and (iii) improving the quality of menus in the kitchens of public institutions by ensuring a more professional and principled procurement procedure.

The present document is designed to provide guidance to policymakers on how these three policy-areas may contribute to the reduction of health inequities. The document takes the form of a narrative review of the criteria suitable for assessing the equity impact of food-and nutrition-related policies (health equity impact assessment criteria), followed by three narrative reviews of the available evidence using these assessment criteria applied to the three specific policy areas.

2. Methods

2.1. Type of review

The present paper describes a four-way literature review to provide a description of the research literature available and their implications for policy development. The review search criteria included peer reviewed academic papers and grey literature from policy-related bodies including national governments and intergovernmental agencies. The present review did not attempt GRADE or any other assessment of the quality of the research reported.

2.2. Purpose

The research question in the first review is *'What health equity impact criteria can be applied to anticipate the effects of health-related food policies on sub-populations'* in which the sub-populations of interest are defined according to recognised socio-economic criteria: household income, neighbourhood deprivation index, parental education status, head of household employment status, or ethnic status. A PICO (Population, Interventions, Comparisons, Outcomes) statement is shown in Table 1. Excluded are age, gender, disability, religious and urban/rural status.

Table 1.1. PICO statement for the literature search for health equity impact for food and nutrition policies

Population	Not restricted
Interventions	Use of health impact analyses especially in the field of food-related health interventions.
Comparisons	The extended criteria used for health *equity* impact assessments.
Outcomes	Identified criteria for anticipating the potential of policies to affect health equity, especially in food-related health policies.

The research question in the case of each set of policies is *'How might the application of the policies differentially affect the diet-related health of sub-populations'* in which the sub-populations of interest are defined according to recognised socio-economic criteria: household income, neighbourhood deprivation index, parental education status, head of household employment status, or ethnic status. Excluded are age, gender, disability, religious and urban/rural status.

Table 1.2. PICO statement for the literature search in respect of three policy areas

	Restriction of children's exposure to promotional marketing of foods and non-alcoholic beverages	***Reformulation of foods and non-alcoholic beverages to support healthier diets***	***Public procurement of food and non-alcoholic beverages to support healthier diets***
Population	Children (< 18 years), especially in European region	All, especially in European region	All, especially in European region
Interventions	Actions to restrict children's exposure to commercial messages for foods and non-alcoholic beverages, or to reduce their strength or impact.	Interventions to reformulate the recipes for commercially produced foods and non-alcoholic beverages for health.	Actions to set standards or improve standards for publicly procured foods and non-alcoholic beverages in order to improve health.
Comparisons	Controlled cross-sectional and longitudinal interventions, uncontrolled survey and observational evidence, interrupted time-series, modelled interventions, mixed methods.		
Outcomes	Measures of exposure, vulnerability, consumption, bodyweight or diet-related health, *differentiated in sub-groups* defined according to social disparities (including socio-economic status, income, occupation, education, neighbourhood deprivation, ethnicity, migrant-status or similar disparity measure; excluding gender, disability, religion, language).		

2.3. Searches

2.3.1 Search terms: social disparities

Search terms for examining social disparities and health inequalities are discussed in the guidance documents which promote the PROGRESS (Welch et al 2012) and PROGRESS-Plus (O'Neill et al 2014) approaches. These documents suggest the following as potential research terms: education, socioeconomic status, occupation, place of residence, race/ethnicity/culture/language, gender/sex, religion, social capital, and other possible factors such as disease status or disability.

All Cochrane systematic reviews include a report on socio-economic dimensions, and therefore no search terms for social disparities were needed. For PubMed and Google the following search terms were used in the present review:

Socioeconomic (OR socio-economic)

Inequality

Disparity

Education (OR educational status)

Other terms which may be considered are: profession, employment, disadvantage, deprivation, poverty, discrimination, social exclusion, ethnicity, race, minority, migrant.

2.3.2 Search terms: health equity impact

For the review of the criteria used in health equity impact assessment, the search terms are summarised in Table 3 (more details are available in Annex 1):

Table 2.1. Abbreviated search terms for health equity impact criteria

PubMed	Health equity impact assessment nutrition Health equity impact assessment food
Cochrane reviews and publications	Health equity impact assessment
Google	Health equity impact assessment and (nutrition or food) *and* Policy impact socio-economic food Europe *and* Risk assessment nutrition socio-economic

For each of the three best practice policies the search terms for the policy description were applied according to the general descriptions listed here (more detailed descriptions of search terms are provided in Annex 1):

Table 2.2 Abbreviated search terms for three policy reviews

	Children's exposure to food and beverage promotion	Food and beverage reformulation	Public procurement of food and beverages
PubMed	(food OR beverages) AND (marketing OR advertising OR commercials) AND child	(food OR beverage) AND (reformulation)	(food OR beverage) AND procurement AND (public OR school OR elderly OR senior)
Cochrane	(food OR beverages) AND (marketing OR advertising OR commercials)	(food OR beverage) AND (reformulation)	(food OR beverage) AND procurement AND (public OR school)
Google	(food OR beverages) AND (marketing OR advertising OR commercials) AND child	(food OR beverage) AND (reformulation)	(food OR beverage) AND procurement AND (public OR school)

Search terms were applied to three databases, and the number of returns reported. After removal of duplicates the returns were examined for relevant titles, and the number of these reported. The relevant titles were traced and the abstracts reviewed for relevant content. Based on the abstracts, full papers were retrieved and examined for research material directly relating to the research question.

2.3.1 Databases examined

Food and health policy papers are well-covered in the US National Library of Medicine database. In addition, the Cochrane library was searched because its systematic reviews routinely include analysis of inequalities, and the Google search engine was used to ensure a range of grey literature could be examined.

Specifically, the databases examined were as follows.

(a) For all reviews:

- National Library of Medicine (https://pubmed.ncbi.nlm.nih.gov/)
- Google (https://www.google.co.uk/)

(b) For the equity impact review:

- Cochrane Methods: Equity (https://methods.cochrane.org/equity/our-publications/)

(c) For the three policy reviews

- Cochrane Library Database of Systematic Reviews (https://www.cochranelibrary.com/)

2.3.4 Search restrictions

The returns from PubMed can include many primary studies of unrelated material. For the purposes of a literature assessment of the three food-related health policies, the search in PubMed was restricted to only 'Review' and 'Systematic Review' papers, and these were limited to reviews published in the last 12 years (since January 2010).

The systematic reviews returned from the Cochrane Library include inequalities as part of their analyses. The Cochrane Publications titles returned were examined for health equity relevance.

The number of returns for Google can amount to several hundreds of thousands. They are returned in approximate order of relevance, and for the purposes of a literature assessment the assumption was made that an examination of the first 100 returns within each of the four searches would be sufficient to represent the material available.

2.3.5 Supplementary literature

The literature returned from the search methods described above included references to additional material considered relevant or referred to EU projects with relevant deliverables. These references were examined and, where relevant, added to the papers reviewed here.

3. Results

The results of the four literature review searches are shown in the PRISMA (preferred reporting items for systematic reviews and meta-analyses) diagrams shown in Annex 1. The search, screening and eligibility examinations resulted in 46 papers included for final analysis for the equity impact criteria, and 43, 41 and 22 papers included for the three policy areas of marketing restrictions, reformulation and procurement, respectively.

3.1. Literature review, and a proposed framework for equity impact assessment.

The search process returned 780 records for review. After elimination of duplicates and non-relevant documents, and the addition of papers discovered in the reference lists and in EU project deliverables, a total of 46 documents were included in the literature review (listed in Annex 2).

The results of the literature review are given below in three sections:

3.1.1. the background material that identifies the relevant issues;

3.1.2. a short-list of papers with potential criteria;

3.1.3. a proposed framework for the criteria.

3.1.1. Background: assessing the potential for inequity in the health outcomes of diet-related health interventions.

Health impact assessment (HIA) tools generally provide protocols for screening, scoping, mitigating, and monitoring health outcomes. In the present review we add the dimension of equity to reflect the need to consider health inequities in the process of assessing interventions. This leads to a health equity impact assessment (HEIA) which considers the social determinants of health, including socio-economic status (SES) related to factors such as household income, head-of-household employment status, adult educational attainment levels, local neighbourhood deprivation indicators, along with other causes of health inequity, such as disability or migrant status (Gunter 2012).

In this section we consider some of the background material that indicate a strong likelihood that food- and diet-related policies can and will have effects on widening or narrowing the differences between population sub-groups.

(a) Several European Commission-funded projects (e.g. *Equity Action* and *Health Equity Pilot Project*) included reviews of the impact of interventions on socio-economic differentials in obesity and diet (Robertson et al 2007, Goldblatt 2018, Lobstein 2014, Lobstein 2017). A further EU-funded project (*STOP – Science and Technology in childhood Obesity Policy*) also considered health equity impact in relation to three policy areas: health-related food taxation, front-of-pack nutrition labelling and restricting marketing of foods to children (Lobstein et al 2020, Lobstein and Neveux 2021). The authors noted a remarkable shortage of conclusive evidence in the research literature, but came to the following conclusions:

(i) Poor evidence base: many studies report their data after controlling or adjusting for SES, thus preventing assessment of differential effects. Much more could be undertaken to re-analyse past projects and to design of future interventions to gather the necessary information.

(ii) Targeted interventions with lower SES groups may indicate the responsiveness among low SES participants but cannot claim to reduce the SES differentials if implemented on a population-wide basis.

(iii) Child obesity interventions: school- or pre-school interventions in younger children with parental/family involvement and sustained over several years may benefit lower SES groups. For older children the benefit of school-based interventions may be greater among higher SES groups. Health-related taxes can reduce socio-economic disparities in childhood overweight. Restrictions to limit children's exposure to advertising for foods and beverages would likely reduce disparities in childhood overweight. There were no studies on the effects of front-of-pack labelling.

(iv) Adult obesity interventions: Environmental and fiscal measures may reduce SES health inequalities, while informational interventions may be less effective, although the UK '5-a-day' campaign may be an exception (it included both social marketing and food labelling measures). Targeted interventions may be effective at improving health behaviour in the targeted group, including weight-loss programmes targeting low SES women.

(v) Sugar-sweetened beverages (SSBs): Multicomponent school- and family-based interventions may achieve a short-term narrowing of the SES gap in consumption among children. For older children and adults, SSB taxation can reduce SES differences in consumption levels.

(vi) Health-related food taxes: A narrowing of the SES gap in dietary behaviour can be expected, especially if combined with subsidies to encourage switching to healthier products

(vii) Informational approaches including computer-based material and social marketing appears either ineffective or widens the gap for older children and adults.

(viii) Free fruit and vegetables: The provision of free fruit in schools may achieve a short-term narrowing of the SES gap in fruit and vegetable consumption among children.

(ix) Trans fats (TFA): Reformulation may achieve a narrowing of the SES gap in TFA consumption. Labelling of industrial TFA or total TFA content on packaging may widen the SES gap in consumption.

(x) Salt: Reformulation can have a population-wide effect and can narrow SES differentials in consumption. Labelling and social marketing to reduce salt consumption – did not reduce differentials.

(xi) Promotional marketing: Interventions in marketing would benefit all groups and may narrow SES health-related differentials. Interventions to reduce TV advertising should have greater impact in lower SES groups, as their exposure is highest and their responsiveness to advertising of unhealthy foods is highest.

(xii) Front-of-pack nutrition labelling: Colour-coded 'traffic light' labelling is superior to numerical coding among people with lower educational status and lower literacy and numeracy. The Nutri-Score method has shown to be most effective among lower-educated and lower-income populations, and red or black 'warning' signals are also likely to be effective.

(b) In the World Health Organization's publication *Obesity and inequities* (Loring and Robertson 2014) the authors make the following recommendations for policy-makers to consider when designing policies (p23-24):

Key policy recommendations

- Most low-income people in Europe know what constitutes a healthy diet. Rather than lack of knowledge, the priority is to address affordability, accessibility, availability and practicalities relating to healthy food.

- Interventions to address obesity at a population level are more likely to be effective than interventions at an individual level, especially for groups of low socioeconomic status.

- Universal policies to improve eating habits, and modifying environments to encourage physical activity are important, but the more deprived groups may require extra measures to benefit from these policies, such as:

    - interventions to address self-esteem, lack of skills and consider the needs and perceptions of disadvantaged women;
    - programmes to help children develop a taste for vegetables, in addition to providing free meals/vegetables and fruit in schools.

- People on low incomes are more price sensitive than those on higher incomes. Taxing foods high in fat, sugar and salt and removing tax on vegetables and fruit are likely to reduce inequities.

- It is important to develop and assess the cost of the contents of a national healthy food basket to help decide the minimum wage and social benefit levels.

- Initiatives to restrict marketing of unhealthy food high in fat, sugar and salt and sugary beverages to children may contribute to reducing inequities, due to the higher exposure and vulnerability of disadvantaged children to marketing.

- Measures to improve the composition of processed foods (e.g. reducing fat, sugar and salt content) have the potential to reduce inequalities, on the condition that their cost is the same, or less than, unhealthy alternatives.

- With a low income, buying unhealthy food may be the most feasible option. Interventions are needed to:

    - increase social protection and income support, to cover the cost of buying a healthy food basket;
    - ring-fence support for food, for example through vouchers for vegetables and fruit;
    - reduce availability and marketing of unhealthy food in disadvantaged areas and schools;
    - promote local supply of vegetables and fruit through initiatives which include the active participation of disadvantaged groups.

- Pregnancy and early childhood are critical periods for intervention on inequities in obesity. Priority interventions include: -

    - paying maternity leave for six months to support exclusive breastfeeding for that period;
    - increasing antenatal care attendance for socially deprived and young women by using participatory methods to address their needs and perceptions;
    - supporting skilled breastfeeding and complementary feeding, tailored to the specific needs of disadvantaged obese mothers, including teenagers, and their families;

- providing free or subsidized healthy meals (including breakfasts), along with vegetables and fruit in schools and early childhood centres.

• Differential access to and treatment within the health system contribute to inequities in obesity. Actions to address this include:

- offering comprehensive health and social support through primary care, maternal and child health services, and social services, addressing service users' perceptions and needs;
- involving marginalized and low socioeconomic groups in the design, delivery and evaluation of services to ensure success.

• New measures are required to address the gender gap in physical activity. This includes: improving physical activity participation of girls at school; improving the physical and cultural safety of spaces for physical activity; and working with disadvantaged girls and women to remove barriers to their physical activity.

• A balanced portfolio of action is needed, aiming for a mix of long- and short-term impacts, addressing the root social causes and consequences of inequities and acting at both individual and environmental levels.

• A system of monitoring and evaluation should be developed (incorporating measured, not self-reported heights and weights) to measure: obesity levels in different socioeconomic groups; social determinants of obesity; and relative success of a range of policies and interventions.

(c) The European Society for the Study of Obesity (EASO) issued a position statement on the need to consider 'upstream', population-based policies to reach all who can benefit, and prevent widening of health inequalities (Rutter et al, 2017). It echoes the work of the Commission on the Social Determinants of Health – which argues for universal interventions with a proportionate effect on those that need it most (Marmot et al 2008) – and the call to recognise the commercial interests of industries that produce health-damaging products (Kickbush, 2016). The EASO statement suggests:

> Public health actions to tackle obesity have historically focused on individual-level changes to diet and physical activity, rather than the upstream actions required to alter the structural drivers of behaviour.
>
> This focus on individual-level behaviour has many limitations. It may well widen inequalities and increase obesity-related stigma, and it diverts attention away from much needed changes to structural and environmental determinants of health.
>
> Although individual-level changes are a necessary component of obesity prevention, they are only one part of a whole system response, and must be supported by upstream actions that focus on promoting healthier physical, economic and social environments.
>
> Actions promoting universal prevention translate into reduced chronic disease burden, increased productivity, economic savings, improved quality of life, and protection of the environment.

3.1.2. Papers identifying potential criteria for health equity impact assessment

Health impact assessment tools often refer to the need to be aware of the social determinants of health, but few of the tools describe the criteria or indicators would help policymakers to judge the potential differential impact of a policy in different population groups. A review of health impact assessment (HIA) tools (Povall et al 2014) found that *'equity is not addressed adequately in HIAs for a variety of reasons, including inadequate guidance, absence of definitions, poor data and evidence, perceived lack of methods and tools and practitioner unwillingness or inability to address values like fairness and social justice. Current methods can address immediate, 'downstream' factors, but not the root causes of inequity. … There is, however, no need for the development of a completely new methodology.'* (p621).

In 2017, a set of papers discussed the need to consider equity issues when applying GRADE assessments of research papers for a systematic review (Welch et al, 2017). The authors suggest that research papers should be evaluated on whether they show five main characteristics:

- Include health equity as an outcome
- Consider patient-important outcomes relevant to health equity
- Assess differences in the magnitude of effect in relative terms between disadvantaged and more advantaged individuals or populations
- Assess differences in baseline risk and hence the differing impacts on absolute effects for disadvantaged individuals or populations
- Assess indirectness of evidence to disadvantaged populations and/or settings.

These criteria may be useful for asking if medical treatments have inequitable outcomes, but a more specific set of questions needs to be developed for diet- and food-related health policies, preferably questions that can be answered with available evidence or can indicate the need for such evidence. A lack of evidence has plagued the development of recommendations, as shown by a review of WHO policy guidelines in the five years 2014-2019 which found that only half had assessed health equity impacts, and even these assessments relied on 'suboptimal' evidence (p125). (Dewidar et al 2020).

In the present literature review we found five relevant approaches that can help develop a formalised health equity impact assessment (HEIA) and identify the nature of the evidence needed. These are described here.

(1) A paper by Gunter developed for the EU-funded Equity Action considers issues that need to be addressed in health equity assessment across a range of public health areas (Gunter 2012). This is also reflected in the *Health Equity Assessment Tool* developed in the UK by Public Health England (PHE 2020) which included several specific questions concerning the potential for policies to affect inequities in health outcomes. These include:

- Which populations face the biggest health inequalities for your topic, according to the data and evidence above?

- Which wider determinants are influential? E.g. income, education, employment, housing, community life, racism and discrimination.
- Which health behaviours play a role?
- Does service quality, access and take up increase the chance of health inequalities in your work area?
- Could your work widen inequalities by:
    - requiring self-directed action which is more likely to be done by affluent groups?
    - not tackling the wider and full spectrum of causes?
    - not being designed with communities themselves?
    - relying on professional-led interventions?
    - not tackling the root causes of health inequalities?
- Could you consider targeting action on populations who face the biggest inequalities?
- Could you design the work with communities who face the biggest health inequalities to maximise the chance of it working for them?
- Could you seek to increase people's control over their health and lives (if appropriate)?
- What output or process measures could you consider?

(2) A document published by the Institute for Public Health in Ireland (IPH 2022) provides guidance on health impact assessment including some specific dimensions which may affect the equity of health outcomes from policy implementation, and which may be relevant for food- and diet-related health policies. It raises issues including the following:

- The sensitivity of a population and its sub-groups: including life stage, deprivation status, health status, capacity to adapt.
- The magnitude of change: potential differences in exposure, scale, duration, frequency, severity, population extent, outcome reversal, and/or service quality implications.
- Health priorities at national and population sub-group levels
- Acceptability by sub-groups, perceived health priorities and policy expectations
- Regulatory standards: opportunities and barriers.

(3) The RE-AIM framework is a tool *'to encourage program planners, evaluators, readers of journal articles, funders, and policy-makers to pay more attention to essential program elements including external validity that can improve the sustainable adoption and implementation of effective, generalizable, evidence-based interventions'*. (https://re-aim.org). RE-AIM stands for Reach, Efficacy, Adoption, Implementation, and Maintenance and identifies useful questions for determining potential inequities in health outcomes of policy implementation. This approach has been used in community interventions for obesity

prevention (Lakerveld 2012, Gubbels 2015). The RE-AIM website provides definitions, to which can be added some specific questions for the purpose of the present review.

Table 3.1 RE-AIM definitions and equity questions

	Definition	Equity assessment questions
Reach	The absolute number, proportion, and representativeness of individuals who are willing to participate in a given initiative, intervention, or program.	Are those that need it most likely to be reached? Within those groups, will the penetration to all members be adequate? Who might be excluded (e.g. homeless people excluded from household survey data)?
Effectiveness (or Efficacy)	The impact of an intervention on important outcomes, including potential negative effects, quality of life, and economic outcomes.	Is there evidence for differential effectiveness? Can the outcomes be measured equally well in all groups?
Adoption	The absolute number, proportion, and representativeness of settings and intervention agents (people who deliver the program) who are willing to initiate a program.	Are there barriers to the implementation of a policy? Are commercial operators involved and do their actions or inactions affect different population sub-groups? Is there evidence that individuals would be likely to adopt changed health behaviour equally across all sub-groups?
Implementation	At the setting level, implementation refers to the intervention agents' fidelity to the various elements of an intervention's protocol, including consistency of delivery as intended and the time and cost of the intervention. At the individual level, implementation refers to clients' use of the intervention strategies.	How completely is a policy or intervention put into practice? Can the policy be implemented to different degrees in different locations or population groups? Are any implementation costs borne by the groups being targeted, both at implementation and in the longer term?
Maintenance	The extent to which a program or policy becomes institutionalized or part of the routine organizational practices and policies. Within the RE-AIM framework, maintenance	Is the policy liable to change over time, e.g. a voluntary policy that can easily be changed or withdrawn?

	also applies at the individual level. At the individual level, maintenance has been defined as the long-term effects of a program on outcomes after 6 or more months after the most recent intervention contact.	Who is responsible for ensuring the policy remains effective? What resources are required to maintain effective implementation? If the policy is altered, would this change the effectiveness among sub-groups?

(4) The WHO document *Obesity and inequities* (Loring and Robinson 2014) referred to above goes on to consider the factors which may cause differential health outcomes, and this is also reflected in the WHO *Handbook for Guideline Development* (WHO 2014) and was presented by WHO at a meeting of the STOP project in 2022 (Lobstein 2023), and included in part in the Joint Action for Health Equity in Europe (Deliverable 9.1) – see JAHEE (2020). The systematised approach to identifying potential causes of differential health outcomes can be summarised in the following table (adapted here from Loring and Robertson to show obesity and food systems concerns):

Table 3.2 Summary of WHO health equity outcomes

Causes of differential health outcomes	Examples of potential inequity
Differential exposure to economic environments, e.g. price differentials, product formulation, marketing of unhealthy products.	• High prices of vegetables, fruit compared with prices of energy-dense, low nutrient, processed food • Availability and price of reformulated food products • Promotional marketing of foods and fast food brands
Differential exposure to the cultural and neighbourhood environment, e.g. local food supplies, distance to retail shops, density of fast food outlets.	• Higher exposure to unhealthy food outlets and lower exposure to healthy food choices • High exposure to neighbourhood advertising of unhealthy foods • Access to beneficial food services, e.g. in pre-school, school, care home
Differential individual vulnerability, e.g. low levels of literacy and numeracy, low levels of nutrition literacy, religious dietary beliefs.	• Less ability to read food labels or nutrition information • Fewer skills and equipment to prepare nutritious foods • Dietary exclusions and requirements, fasting periods

Differential access to health products and services, e.g. skewed availability, financial barriers, products and services with poor acceptability.	• Distance and cost barriers to accessing health service consultation (e.g. child growth check-ups) • Language and belief barriers to accessing health advice
Differential benefit from health-supporting services, e.g. access to higher education, access to health promotion resources, access to weight management services (cost and availability of service, discrimination in service delivery, quality and relevance of treatment plan).	• Reduced education and employment opportunities and attainment levels • Different treatment within the health care system • Impact of discrimination on motivation to follow advice • Comprehension of treatment regimes • Adequate resources to comply with treatment regimes
Differential consequences of diet-related illness and disability, e.g. loss of income, impoverishment/catastrophic health expenditure, stigmatization or other forms of discrimination.	• Increased need for long-term care services • Additional stress on household resources • Impact on self-esteem and social inclusion/exclusion • Co-morbid il-health, depression, premature death

(5) Lastly, **Backholer and colleagues** (Backholer et al 2014, Beauchamp et al 2014, Backholer and Peeters 2017) have developed a framework for assessing the impact of obesity prevention strategies on socio-economic inequalities in weight.

The framework distinguishes three types of intervention along an axis from **agency** (behaviour led by individual choice) through to **structure** (the social, economic, political and material context in which behaviour occurs). Interventions aimed at individual agency typically rely on information and education to increase knowledge, skills, or empowerment of individuals to make healthier choices. Interventions located at the structural end of the spectrum typically remove individual agency, rendering the healthier option the only option, in a given context. Such interventions are typically enacted through regulatory changes. It is also recognized that interventions may be **agento-structural**, i.e. they may alter the structural conditions in favour of health, making health-enhancing behaviours more appealing, accessible, or affordable, while also ensuring individuals still have the right to make the same health behaviour choices that were available before the intervention.

The framework also recognises two levels of intervention, one at the local level (‘micro’) and one at the wider community or national level (‘macro’). The diagram below is reproduced from the *American Journal of Public Health* (Backholer et al 2014). Using this framework, the authors examine different policy opportunities in a variety of public health measures (e.g.

vaccination, seat belts, nutrition standards, portion sizes etc), and suggest that highly agentic interventions were likely to widen health inequities, while structural interventions tended to reduce inequities. Between these, a wide range of agento-structural interventions were considered, but the data were limited and showed varied effects, although interventions at the macro-environmental level appeared more likely to reduce inequities than those at the micro-environmental level.

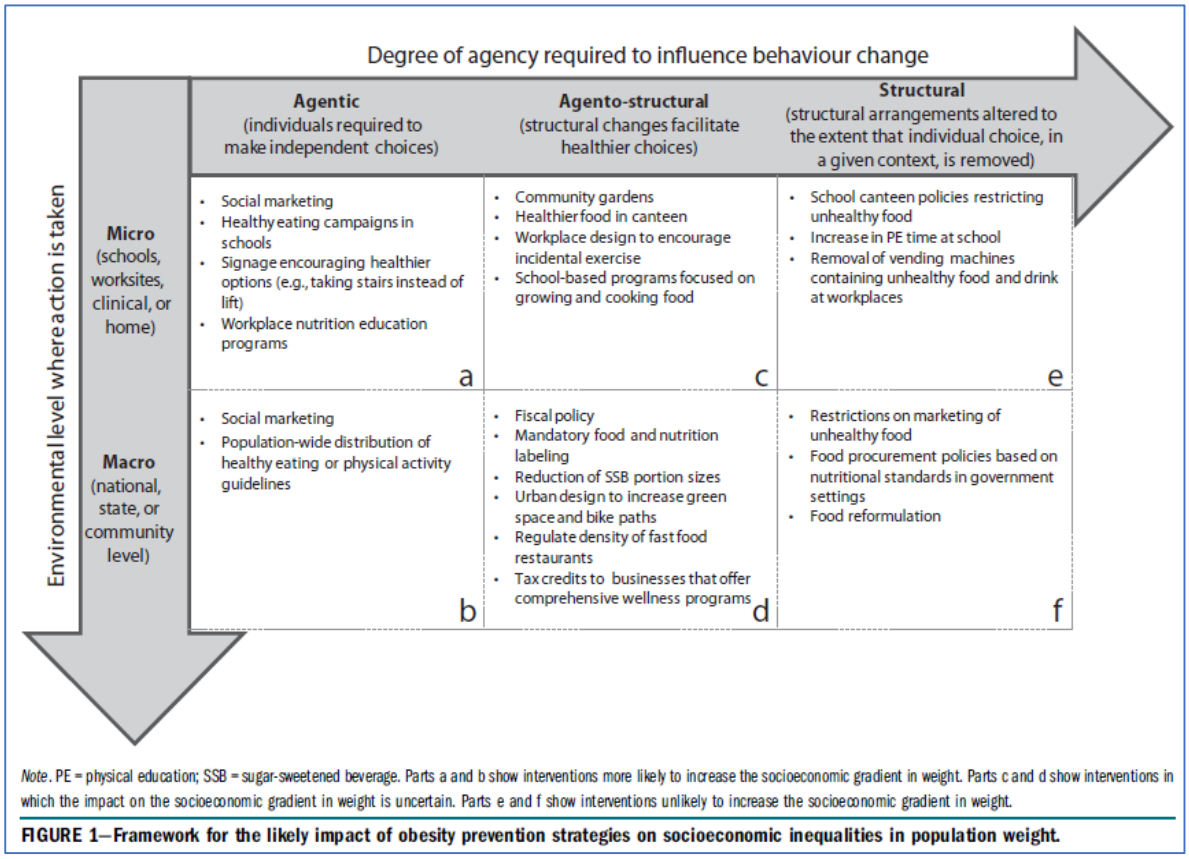


Figure 3.1. Proposed framework for the impact of obesity prevention strategies on socio-economic inequities in population weight status (from Backholer et al 2014)

Using this framework, a review by Olsted et al (2016) suggested that the difference in effects on health inequities between agentic, agento-structural and structural interventions were small, with agento-structual interventions being slightly better, and agentic interventions slightly worse in respect of effects on health equity. A re-examination of Olsted's data by Backholer and Peeters (2017) showed that, in general, agentic interventions implemented in isolation are more likely to increase inequities in obesity and related behaviours, whereas structural interventions are less likely to do so. The authors add *'We agree with Olstad et al. that in reality a suite of policy measures to address the high and inequitable prevalence of obesity are required across the agency-structure continuum*'. (p127). Further evidence supports this position: a systematic review of whole-of-community interventions to tackle weight gain (Boelsen-Robinson, 2015) found that those interventions most likely to reduce inequity in health outcomes '*incorporated structural changes to the environment, acted across more than three settings and/or employed community engagement'* (p 806).

3.1.3. A composite framework for health equity impact assessment

From the review above it is possible to identify a short-list of potential sources of inequity to take into account in policy and intervention design, and some the criteria on which they can be assessed. The types of evidence for each of the criteria would need to be determined according to the policy or intervention being considered. Consultation with participants in the implementation may help clarify the evidence needed and the sources of that evidence.

Table 3.3. Proposed framework for an equity impact assessment for diet-related health policies

Source of inequity	Assessment criteria	Examples of evidence needs
Pre-occurring risk	Underlying health or diet differences	Does one group eat a less healthy diet (e.g. more salt)? Would they benefit more from change?
	Vulnerability or susceptibility	Is one group more responsive to advertising? Or to price modification?
	General exposure to potential source of risk	Is one group more exposed to TV advertising?
	Targeted exposure to potential source of risk	Is one group more dependent on social food provision? Is TV advertising targeted at sub-groups?
Reach and type of policy or intervention	Reach of policy across subgroups/gradient	Do information campaigns reach all groups? Are there language issues? Is it universal? Proportionate?
	Degree of penetration within sub-groups	Within poorer groups, are homeless people reached? Or adolescents after leaving home?
	Localised (micro) or widespread (macro)	Are reformulated foods available in all shops?
	Is it upstream or downstream?	Does the policy target upstream (e.g. food companies) or downstream (consumers)?

	Reach of supportive messaging	Do health messages in support of reformulation regulations reach all groups?
	Access to supportive services	Do welfare food vouchers reach all those in need?
Response to intervention	Agency- or structure-led behaviour change	Does the policy require individual voluntary changes in behaviour? Is the healthier choice the easier choice?
	Resource requirements	Does behaviour change require financial, time or equipment resources? Are reformulated products more expensive?
	Skills, literacy and numeracy requirements	Does behaviour change require skills to implement? Do food labels need literacy or numeracy skills?
	School-to-home transfer of behaviour changes	Do school-based programmes to drink water or eat fruit transfer easily to the home environment?
	Household-level acceptability of intervention	Are behaviour changes suitable for all cultures? What about periods of fasting?
	Household-level perceived priority	Is the behaviour change competing with other priorities? Are all members of a household motivated?
Sustainability of response	Compatibility with community and cultural environment	Are policies in concordance with existing dietary patterns and food supply environments? Are fast food outlets competing with a policy?
	Voluntary vs regulatory	Does the policy have statutory support? Can it be ignored in some areas, or reversed easily?

	Barriers/threats to policy maintenance	What might undo the policy? Is this more likely in some communities or sub-groups?

In the next section of this literature review we take the checklist described here and discuss the evidence available to help make an equity assessment of the three Best-ReMaP policy areas.

3.2. Summary of literature on health inequalities in relation to food and beverage marketing restrictions.

The previous section identified four areas where inequities need to be considered (underlying risks, reach of the intervention, response, and sustainability of the response), and within these a series of specific issues that need to be addressed. In this section we consider the evidence base with respect to the three policy areas in the Best-ReMaP Joint Action, starting with restrictions on the promotional marketing of foods and beverages to children.

From the search for relevant documents, the review found 248 records and after removal of duplicates and less relevant documents, included 43 documents for the present review (see PRISMA chart in Annex 1). In summary, the evidence available suggests the following:

1. Underlying or pre-occurring risk

a) Underlying health or diet differences

Finding: Evidence of greatest need among lower SES children.

A gradient in children's obesity prevalence according to household income, parental education or other measures of deprivation or disadvantage has been recorded in nearly all western and central European countries, with the Health Behaviour of School-aged Children (HBSC) survey of 2017-18 showing greatly increased differentials between higher and lower affluence adolescents compared with previous surveys (Inchley et al 2020). The UK's school measuring programme covering all children aged 5 and 10 years shows obesity prevalence highly correlated with ten levels of neighbourhood deprivation and a trend of increasing health inequity (OHID 2022a). A review by the STOP project found consistency across most surveys, using different measures of socio-economic status (Sares-Jäske et al 2022.

The HBSC survey also shows a gradient in the consumption of unhealthy diets of adolescents, with lower consumption of sugar-sweetened beverages and greater consumption of fruit and vegetables associated with more affluent households (Inchley et al, 2020). Similar patterns are found in the survey of younger children (aged 10-12y) in seven European countries in the EU ENERGY project (Brug et al, 2012).

b) Vulnerability or susceptibility

Finding: Some evidence of greater vulnerability in lower-SES children.

A survey of young people from the more deprived areas of the UK (Thomas et al 2019) found they had a poorer awareness of health conditions associated with overweight and obesity, indicating potential greater vulnerability to messages for unhealthy behaviour. Children with overweight or obesity appear more vulnerable to the influence of food advertising on TV (Tedstone et al 2022, DHSC 2021). A survey by the UK's official media regulator Ofcom found children in lower income households

'displayed lower levels of critical understanding in recognising advertising and what is genuine online' (Ofcom 2022, page 15)

c) General exposure to potential obesogen / marketing messages

Finding: Evidence of greater exposure in lower SES groups.

A systematic review of evidence found children from minority and socio-economically disadvantaged backgrounds are disproportionately exposed to unhealthy food advertising (Backholer et al 2019) primarily due to their greater exposure to screen-based media with commercial content (DHSC, 2021). A survey of households in the Netherlands found children's exposure to food advertising was significantly related to their consumption of advertised brands and energy-dense product categories, and that the relation between advertising exposure and overall food consumption was most apparent in lower-income families (Buijzen et al 2008).

The 2017-2018 HBSC survey found higher TV viewing in lower SES households, and this was associated with higher consumption of unhealthy foods and lower consumption of healthier foods (Inchley et al, 2020). A 2022 review of children's exposure to the marketing of HFSS foods found evidence for a dose-response relationship between exposure and child obesity, particularly for children from socially disadvantaged and minority ethnic backgrounds (Coleman et al 2022).

d) Targeted exposure to potential obesogen // marketing messages

Finding: Evidence of targeting of lower-income or minority groups.

Advertisers are aware that certain population groups may be more susceptible to advertising messages, and collect data to profile and target particularly vulnerable groups, for example targeting by ethnic group (Tatlow-Golden and Garde, 2020). This can increase young people's responsiveness – further amplifying existing economic and other inequalities. Targeted advertising, with a focus on ethno-specific actors, role models, influencers, and others of particular appeal to targeted children (CSPI, 2021), can increase receptivity to the messages and, combined with greater exposure based on targeting, is likely to result in amplified responsiveness.

Two surveys of outdoor advertising in the UK found evidence of social inequalities with a larger proportion of food advertisements located within deprived areas and areas more frequented by students (Adams et al 2011, Palmer et al, 2021). Advertising on transport networks reaches population groups that use public transport, such as schoolchildren from lower-income households (Olsen et al 2021).

2. Reach and type of policy or intervention

a) Reach across subgroups/gradient

Finding: Reach in proportion to exposure: universal and proportionate.

Proposed policies to restrict marketing can be expected to apply to advertising messages which reach all communities, including through TV, online and localised advertising (e.g. near schools). In France, the public health agency, Santé Publique France, recommends restricting advertising of HFSS products to help tackle socio-economic inequalities in health (Serry et al, 2020). A modelling of the impact in the UK of a ban on TV advertising before 9pm of high fat, sugar or salt (HFSS) foods indicated greater reduction in exposure in lower income households (also households with lower head-of-household skills level or in more deprived neighbourhoods) (Griffith et al, 2019). The impact assumed the advertisers responded fully to the ban and did not increase advertising after 9pm.

For targeted advertising, policies may need to restrict paid content in posts generated through web-based communities and influencers (Kelly et al 2021), especially messages reaching younger, more vulnerable audiences.

In principle, marketing restrictions are population wide, but will have an effect in proportion to the exposure to the advertising messages, and therefore this is a universal, and proportionate intervention.

b) Degree of penetration within sub-groups

Finding: No evidence found.

Policies to introduce advertising restrictions are expected to affect all population groups in proportion to their pre-ban exposure. There appear to be no studies on how restrictions on advertising may be implemented differentially within sub-groups.

c) Localised (micro) or widespread (macro)

Finding: At both levels interventions would improve health equity

Population (macro) level interventions cover all population in proportion to exposure. Restrictions on localised advertising, e.g. on streets, buildings or transport facilities, will have an impact in health inequalities in proportion to the demographics of the area where they are displayed. The studies of outdoor advertising by Adams et al (2011) and Palmer et al (2021), referred to above, found a greater number of food advertisements in lower-income neighbourhoods, implying that restrictions would benefit lower SES populations the most.

d) Is it upstream or downstream?

Finding: Upstream: likely to improve health equity.

Restricted advertising of specific products is an upstream intervention in the commercial marketplace, which tackles the social and commercial drivers of ill health (Kickbush 2016, Rutter et al 2017). In principle it can be expected to benefit all at risk of exposure and reduce health inequalities.

e) Reach of supportive messaging

Finding: No evidence found.

This review found no studies of the impact of public health messages which support the introduction of advertising restrictions. Examples of messages might include the public relations efforts of advertisers in the promotion of voluntary industry restrictions on advertising. However, these messages appear designed primarily to counter calls for statutory regulation and so would be aimed at political actors, policy officials and mainstream media.

f) Access to supportive services

Finding: No evidence found.

There appear to be no studies of any supportive services to aid population groups in implementing or accepting the marketing restrictions.

3. Response to intervention

a) Agency- or structure-led behaviour change

Finding: Structure-led: likely to improve health equity.

The intervention changes the obesogenic environment without requiring conscious behaviour change and falls within category ‘f’ (the most structural category) in the framework by Backholer et al (2014) – see Figure 3.1 above.

b) Resource requirements

Finding: No resource requirements for individuals.

No personal resources are required to implement advertising restrictions. Other potential costs are unlikely to have a specific effect on health equity:

(i) Suggestions by the advertising industry that HFSS bans would increase the cost of media programming. These suggestions do not appear to be born out: a review after

three years of implementation of the UK's 2006 ban on HFSS food advertising during children's programming found '*children's channels saw a significant decline in food and drink advertising revenue. However, data provided by broadcasters indicates that total advertising revenue on children's channels has nevertheless increased overall'* (Ofcom, 2008, page 43).

(ii) There are costs to the public finances of implementing and monitoring advertising restrictions, but these are relatively small and are likely to be highly cost-effective (Lobstein et al, 2020, Coleman et al 2022).

(iii) Total costs to advertisers in lost sales. This occurs if advertising was causing the market to increase overall, otherwise advertising is competing between producers for a constant market and there are no net lost sales. On the other hand, there is a net gain to advertisers from the savings made by not spending on advertising.

c) Skills, literacy and numeracy requirements

Finding: No personal skills, literacy or numeracy required.

Children do not need specific skills or degrees of literacy or numeracy in order to benefit from advertising restrictions.

d) School-to-home transfer of behaviour changes

Finding: No school-to-home transfer required.

There is no implication for school-to-home transfer of implemented policies.

e) Household-level acceptability of intervention

Finding: No evidence of differential acceptability.

A review of the acceptability of restricting children's exposure to HFSS food advertising found evidence for high levels of acceptability among parents, teachers and health workers (Lobstein et al 2020). There was no evidence of differential acceptability by population sub-group.

f) Household-level perceived priority

Finding: No evidence of differential perceived priority.

No evidence was found on whether the prioritisation of a policy to restrict children's exposure to HFSS food advertising was differentiated by socio-economic or other sub-group classification. There are suggestions that advertising of any product can create stress within families (Young et al 2003, Dens et al 2007), and although this may be particularly true if the product is unaffordable within the household budget indicating

that advertising restrictions may be more important for less affluent parents, there appears no evidence for this being a significant factor.

4. Sustainability of response

a) Compatibility with community and cultural environment

Finding: No evidence for differential compatibility.

There appear to be no studies on the compatibility of advertising restrictions according to community or cultural standards and practices.

b) Voluntary vs regulatory

Finding: Regulatory implementation likely improves health equity

Several studies have concluded that statutory or co-regulatory measures are more effective at reducing exposure of children to HFSS food advertising, compared with industry voluntary measures (Galbraith-Emami and Lobstein 2013, Chambers et al 2015, Kent et al 2022, Coleman et al 2022). To the extent that children are differentially exposed, the policies that are better able to restrict children's exposure should similarly improve health equity.

c) Barriers/threats to policy maintenance

Finding: Commercial resistance could widen health inequity.

Industry-led resistance to the introduction or strengthening of advertising restrictions perpetuates the current level of health inequity. Industry-led voluntary restrictions can be harder to monitor and can be rapidly altered or withdrawn compared with statutory measures, and their weakening or withdrawal potentially widens health inequity. Overcoming these threats with strong, regulatory restrictions affecting multiple media platforms would be expected to have the greatest beneficial health equity impact for children and potentially for adults.

Table 3.4. Summary table for evidence of health equity impact of restricting children's exposure to food marketing

Source of inequity	Assessment criteria	Summary of evidence
Pre-occurring risk	Underlying health or diet differences	Evidence of greatest need among lower SES children
	Vulnerability or susceptibility	Some evidence of greater vulnerability in lower-SES children.
	General exposure to potential obesogen	Evidence of greater exposure in lower SES groups
	Targeted exposure to potential obesogen	Evidence of targeting of lower-income or minority groups.
Reach and type of policy or intervention	Reach across subgroups/gradient	Reach in proportion to exposure: universal and proportionate.
	Degree of penetration within sub-groups	No evidence found.
	Localised (micro) or widespread (macro)	At both levels interventions would improve health equity
	Is it upstream or downstream?	Upstream: likely to improve health equity.
	Reach of supportive messaging	No evidence found.
	Access to supportive services	No evidence found.
Response to intervention	Agency- or structure-led behaviour change	Structure-led: likely to improve health equity
	Resource requirements	No resource requirements for individuals. (Low costs to media platforms, potential savings to advertisers, low cost to public finances.)

	Skills, literacy and numeracy requirements	No personal skills, literacy or numeracy required.
	School-to-home transfer of behaviour changes	No school-to-home transfer required
	Household-level acceptability of intervention	No evidence of differential acceptability.
	Household-level perceived priority	No evidence of differential perceived priority.
Sustainability of response	Compatibility with community and cultural environment	No evidence for differential compliance
	Voluntary vs regulatory	Regulatory implementation likely improves health equity
	Barriers/threats to policy maintenance	Commercial resistance could widen health inequity.
Overall		**Health equity increases, especially with strong regulatory implementation**

3.3. Summary of literature on health inequalities in relation to food and beverage reformulation.

Section 3.2 identified four areas where inequities need to be considered (underlying risks, reach of the intervention, response, and sustainability of the response), and within these a series of specific issues that need to be addressed. In this section we consider the evidence base with respect to the policy area in the Best-ReMaP Joint Action concerning food reformulation towards reductions in the consumption of foods high in fats, sugars or salt (HFSS).

From the search for relevant documents, the review found 131 records and after removal of duplicates and less relevant documents, 41 documents were included for the present review (see PRISMA chart in Annex 1). In summary, the evidence available suggests the following:

1. Underlying or pre-occurring risk

a) Underlying health or diet differences

Finding: Evidence of greatest need among lower SES groups.

The evidence for children is identical to that in the previous summary (for marketing restrictions) and indicates children in lower income households or in more deprived neighbourhoods have less healthy diets (e.g. more sugar-sweetened beverages, less fruit and vegetables). Children in lower income households are also more likely to experience overweight and obesity. For adults, the data from Eurostat indicates similar patterns, with adults in lower income groups or with lower educational attainment levels likely to have poorer diets (assessed with sugared drinks and fruit and vegetable consumption) in most European countries (Eurostat 2022). Similarly, adult overweight and obesity is more common among lower income adults in most European countries (Eurostat 2022). Estimates of salt (sodium) consumption in the UK indicate greater consumptions levels in lower income groups (Ji and Cappuccio 2014).

b) Vulnerability or susceptibility

Finding: Price sensitivity may disadvantage lower-income households.

Lower income households are more price sensitive (Powell and Chaloupka 2009, Steenhuis et al 2011, Ni Mhurchu et al 2013), indicating that reformulation may increase health inequity if producers introduce price increases for reformulated compared with un-reformulated products.

c) General exposure to potential obesogen / un-reformulated products

Finding: Exposure is proportional to purchase across all groups

Exposure to un-reformulated products is proportional to their purchase and consumption. In the case of salt and *trans*-fats this may show a gradient of greater *per*

capita consumption among lower-income households. Sugar consumption in soft drinks tends to be higher in lower income groups, although sugar consumption overall appears less differentiated. Fats and calorie consumption tend to be higher in lower income groups (Boylan et al 2011).

d) Targeted exposure to un-reformulated products

Finding: Targeted promotion may increase low SES exposure

Evidence cited earlier (for marketing restrictions) suggests HFSS foods are promoted to a greater extent among lower income groups through mass media and localised advertising. Additional evidence of targeted promotion of HFSS products aimed at adults comes from studies of print media: for example, Adams and White (2009) and Adams et al (2011) found greater promotion of HFSS foods in women's magazines targeting lower income readers.

2. Reach and type of policy or intervention

a) Reach across subgroups/gradient

Finding: Mandatory reformulation likely to be universal and proportionate.

Reformulation reaches all those who are habitual purchasers of a product. Two studies indicate that reformulation to reduce *trans*-fats would be of greater benefit to lower-income consumers, potentially improving health equity (Hutchinson et al 2018, Marklund et al 2020). An assessment of salt reduction policies in the UK found reformulation to be more effective than new product introduction, and both were more effective than health-promotion messaging: the findings were consistent across socio-economic groups, suggesting the programme as a whole did not widen salt consumption disparities.

If reformulation is not mandatory or industry-wide, then socio-economic differences may be increased: for example the differences in sensitivity to food product prices noted above can affect purchasing patterns and disadvantage lower income families, potentially increasing health inequity (Storcksdieck-Genannt-Bonsmann and Wills 2012). If reformulated foods are promoted by nutrient claims on the label alongside regular versions that are not promoted this may have a differentiating impact on households by educational class or literacy levels:

In principle, mandatory reformulation is population wide, but will have an effect in proportion to the consumption of the products being reformulated, and therefore this is a universal and proportionate intervention.

b) Degree of penetration within sub-groups

Finding: No evidence found.

Reformulation interventions assume that they will reach across all population groups in proportion to their purchasing. There is some evidence that some lower income households may compensate for salt reduction by purchasing alternative, saltier products (Griffith et al 2014), but it is not clear if this is consistent for specific types of lower-income household. Price sensitivity will also have an impact, but there is no evidence how this might affect sub-groups within low SES households.

c) Localised (micro) or widespread (macro)

Finding: Macro, affecting all consumers of the specific products

d) Is it upstream or downstream?

Finding: Upstream: Likely to improve health equity

Reformulation alters the availability of healthy and unhealthy foods in the market, and is an upstream measure. It tackles the social and commercial drivers of ill health (Kickbush 2016, Rutter et al 2017). In principle, the measure should benefit all at risk and reduce health inequalities.

e) Reach of supportive messaging

Finding: Possibly greater reach in higher income groups

Public health messaging related to reformulation campaigns are likely to have a greater reach with higher educated and more literate and numerate population groups (Barberio et al 2017, Thompson et al 2018).

f) Access to supportive services

Finding: No evidence found

There appear to be no studies of any supportive services to aid different population groups in selecting reformulated products.

3. Response to intervention

a) Agency- or structure-led behaviour change

Finding: Mandatory reformulation is a structure-led intervention.

Mandatory reformulation changes the environment without requiring conscious behaviour change, and falls within category ‘f’ (the most structural category) in the framework by Backholer et al (2014) – see Figure 3.1 above.

b) Resource requirements

Finding: Resource requirements if there are price differentials

Mandatory reformulation across all producers should avoid price increases, but voluntary reformulation may result in price differentials favouring the un-reformulated product. Price differentials would likely increase health inequities.

c) Skills, literacy and numeracy requirements

Finding: Choice may require literacy or numeracy

Reformulation across all products should not require knowledge or skills on the part of the purchaser but if there are choices between reformulated and un-reformulated similar products then consumers may be required to compare labels and understand nutrition lists and health claims which can lead to greater health inequity.

d) School-to-home transfer of behaviour changes

Finding: No school-to-home transfer required

There is no implication for school-to-home transfer of implemented policies.

e) Household-level acceptability of intervention

Finding: Some resistance to reformulated products

An analysis of the UK salt reduction programme indicated that some of the benefit of reduced salt in re-formulated foods was offset by increased purchasing of other, saltier food products, especially among lower-income households (Griffith et al 2014). This tendency could undermine part of the improvement to health equity.

f) Household-level perceived priority

Finding: No evidence of differential perceived priority.

No evidence was found on whether the prioritisation of a policy to reformulate food products was differentiated by socio-economic or other sub-group classification.

4. Sustainability of response

a) Compatibility with community and cultural environment

Finding: No evidence of community incompatibility.

There was no evidence that reformulation was incompatible with community or cultural standards and practices.

b) Voluntary vs regulatory

Finding: Enforceable reformulation maximises health equity improvement

Mandatory or co-regulatory reformulation is likely to be more successful, be easier to monitor and, if it is industry-wide, should effectively reach all purchasers of the products. Reformulation undertaken voluntarily requires independent monitoring and is open to unannounced change or withdrawal – as happened with Campbells Soup which reformulated to reduce salt in 2010 and reversed this in 2011 (Arumugam 2011). A review of modelling studies comparing mandatory and voluntary reformulation interventions, mandatory scenarios were always found to be more effective (Federici et al 2019). In the UK a salt reduction programme with threats of regulation and close monitoring with published brand results achieved a 15% reduction in population average consumption (He et al 2014) while a less intensive voluntary programme for sugar reduction aimed for a 20% decline in consumption over 5 years and achieved only 3.5% (OHID 2022b, 2022c).

c) Barriers/threats to policy maintenance

Finding: Commercial interests may undermine equity benefits of reformulation

There was evidence that commercial interests may promote voluntary reformulation measures which are not applied across all similar products, and which may be withdrawn at short notice, thus undermining any improvement in health equity.

Table 3.5. Summary table for evidence of health equity impact of food reformulation

Source of inequity	Assessment criteria	Summary of evidence
Pre-occurring risk	Underlying health or diet differences	Evidence of greatest need among lower SES groups
	Vulnerability or susceptibility	Price sensitivity may disadvantage lower-income households.
	General exposure to potential obesogen	Exposure is proportional to purchase across all groups
	Targeted exposure to potential obesogen	Targeted promotion may increase low SES exposure

Reach and type of policy or intervention	Reach across subgroups/gradient	Mandatory reformulation likely to be universal and proportionate.
	Degree of penetration within sub-groups	No evidence found.
	Localised (micro) or widespread (macro)	Macro, affecting all consumers of the specific products
	Is it upstream or downstream?	Upstream: Likely to improve health equity
	Reach of supportive messaging	Possibly greater reach in higher income groups
	Access to supportive services	No evidence found
Response to intervention	Agency- or structure-led behaviour change	Mandatory reformulation is a structure-led intervention
	Resource requirements	Resource requirements if there are price differentials
	Skills, literacy and numeracy requirements	Choice may require literacy or numeracy
	School-to-home transfer of behaviour changes	No school-to-home transfer required
	Household-level acceptability of intervention	Some resistance to reformulated products
	Household-level perceived priority	No evidence of differential perceived priority
Sustainability of response	Compatibility with community and cultural environment	No evidence of community incompatibility.
	Voluntary vs regulatory	Regulatory or co-regulatory reformulation maximises health equity improvement

	Barriers/threats to policy maintenance	Commercial interests may undermine equity benefits of reformulation
Overall		**Health equity increases, especially through statutory regulation or co-regulatory collective agreement**

3.4. Summary of literature on health inequalities in relation to food and beverage public procurement.

Section 3.2 identified four areas where inequities need to be considered (underlying risks, reach of the intervention, response, and sustainability of the response), and within these a series of specific issues that need to be addressed. In this section we consider the evidence base with respect to the policy area in the Best-ReMaP Joint Action concerned with food procurement to ensure better access to attractive and nutritious foods in institutions.

From the search for relevant documents, the review found 124 records, the majority of which focussed on the provision of food in schools. After removal of duplicates and less relevant documents, 22 documents were included for the present review (see PRISMA chart in Annex 1). In summary, the evidence available suggests the following:

1. Underlying or pre-occurring risk

a) Underlying health or diet differences

Finding: Evidence of greatest need among lower SES groups

As noted in section 3.4 concerning food reformulations, the HBSC survey reports that for most countries in the region adolescents in lower affluence households have less healthy diets (e.g. more sugar-sweetened beverages, less fruit and vegetables) and are also more likely to experience overweight and obesity (Inchley et al 2020). For adults, the data from Eurostat indicates similar patterns, with adults in lower income groups or with lower educational attainment levels likely to have poorer diets (assessed with sugared drinks and fruit and vegetable consumption) in most European countries (Eurostat 2022). There is also evidence of poorer micro-nutrient status in lower socio-economic groups in Europe (Novaković et al 2014). As noted with children, adult overweight and obesity is more common among lower income men and, especially, women in most European countries (Eurostat 2022).

b) Vulnerability or susceptibility

Finding: Price sensitivity and resistance to change may be higher in low SES groups.

Lower income households are more price sensitive (Powell and Chaloupka 2009, Steenhuis et al 2011, Ni Mhurchu et al 2013), indicating that improved procurement may increase health inequity if it results in price increases for menu items available.

c) General exposure to potential obesogen / poor food procurement

Finding: Exposure to poor food procurement may show a socio-economic gradient

Food procured by state-run or public institutions will cater to a range of clients including children, older people, hospital patients and staff in all public bodies. Schools

in some countries provide food at reduced cost or at no cost to children from lower-income households, indicating a possible socio-economic gradient in exposure to school meals. Similarly, social support for elderly people may include subsidised or free meal services, which may be delivered specifically to lower-income clients. Budget constraints for food provision for schoolchildren or older or vulnerable people in care institutions may create difficulties providing food that is attractive and nutritious (Partridge et al 2022, Weale 2022), and these budget constraints may apply more in the case of institutions for lower income beneficiaries. While poor food procurement policies can affect all users of all catering facilities, they may especially impact on lower income groups and it is reasonable to assume that in principle exposure to risk is likely to show a socio-economic gradient.

d) Targeted exposure to potential obesogen / poor food procurement

Finding: No evidence of deliberate targeting of socio-economic subgroups.

While budgetary constraints may reduce the ability to procure and provide attractive and nutritious food, this review found no evidence that there was deliberate targeting of certain sub-groups with poor food procurement policies.

2. Reach and type of policy or intervention

a) Reach across subgroups/gradient

Finding: Limited evidence of reach across all groups: likely universal and proportinate.

Raising nutrition standards may achieve improvements in school meals consumed, but the evidence is limited and shows only small improvements for children from more deprived neighbourhoods compared with children from less deprived neighbourhoods (Dubuisson et al 2010, Spence, Delve et al 2014, Spence, Matthews et al 2014). Evidence from the review of the EU Farm to Fork Strategy for schools suggests widely varying uptake of the fruit, vegetables and certain milk support schemes by different member states and different implementation administration (European Commission 2023), which may affect the penetration of the measure across and within different socio-economic groups.

b) Degree of penetration within sub-groups

Finding: Limited evidence that improved food standards reach all within subgroups.

Government-led standards for food provision for free or subsidised meals may not be supported by adequate budgets, which may especially affect lower-income groups (Partridge et al 2022). One reviewer notes '*publicly funded, nutritious school meals protect children from the direct effects of poverty on their food security, whilst*

underfunded and weakly regulated school food provision compounds children's experiences of disadvantage and exclusion' (O'Connell et al 2022, p251).

In addition, access to free and subsidised food provision should reach all who are eligible, but in practice there may be knowledge, literacy and language barriers to proving entitlement.

c) Localised (micro) or widespread (macro)

Finding: Both localised practices and national standards

Improved food procurement will be seen at local level, but the measure may be based on standards agreed at regional or national level, by a local educational or social service authority or national education or welfare services department.

d) Is it upstream or downstream?

Finding: Primarily upstream with potential to improve health equity

Setting standards for food procurement is primarily an upstream measure agreed at regional or national level and applied to a set of institutions. It tackles the social and commercial drivers of ill health (Kickbush 2016, Rutter et al 2017). In principle, the measure should benefit all at risk and reduce health inequalities, although implementation in practice (including inadequate financing but also other issues experienced by users, such as long queues, cramped canteens, small portions, limited options, slow service, teachers' attitudes) may affect health equity outcomes.

e) Reach of supportive messaging

Finding: No evidence of differential reach of messaging

Messaging concerning the improvement to food catering provisions may be made to clients or to children's parents, and is likely to reach all potential beneficiaries.

f) Access to supportive services

Finding: Potential differential access to supportive services

Access to and entitlement to subsidised or free catering, such as free school meals, can require administrative issues, and this can be a potential barrier affecting some groups more than others. As one report noted: '*Programmes that target on the basis of individual need also require a process to confirm eligibility. This can add costs and complexity and discourage eligible families from taking part, meaning some children needing lunch will miss out'* (New Zealand Ministry of Education 2023).

Other forms of supportive services may be directed to the providers, for example guidance to food procurement officers and training for catering staff. There is no evidence that these might affect SES groups differentially.

3. Response to intervention

a) Agency- or structure-led behaviour change

Finding: Structure-led with some limited agency

Improved food procurement is primarily a structure-led intervention, but it relies on the improved menus being attractive and priced competitively in order to ensure the food is actually purchased and consumed. For example, children eligible for subsides or free meals will presumably accept the changes but children with the freedom to purchase foods outside the school may not participate in the improved food provision, indicating that some agency is present, especially for those with resources to choose not to participate in the improved menus. For catering in other institutions such options may not be available, and improved procurement should affect all users.

While improved procurement is placed in category ‘f’ in the Backholer et al (2014) framework (i.e. strongly structure-led) in certain circumstances (e.g. older school children) some agency is available to opt out of the catering provided.

b) Resource requirements

Finding: Costs may act as a disincentive

Improved food procurement may increase the cost of using institutional catering services and be a disadvantage for those on a low income unless they can benefit from subsidised or free access. Improved food procurement may require training for the catering staff and possibly additional catering equipment, which may disadvantage schools and institutions in less affluent neighbourhoods.

c) Skills, literacy and numeracy requirements

Finding: No skills, literacy or numeracy is required

Improvements to catering should not require knowledge or skills on the part of the beneficiary. Skills for the catering staff may require training, which may not be easily available for schools in more deprived neighbourhoods.

d) School-to-home transfer of behaviour changes

Finding: Mixed evidence of school-home relations

Schools are a source of information on what is healthy to eat, and improved menus can be educational for children and, if they bring the information home, the family also. There appears no evidence on whether this process occurs differentially across socio-economic groups. There is some largely anecdotal evidence of resistance to 'healthier' menus by children or parents (Wainwright 2006, Ligaya 2012), although it is not clear if this raises socio-economic or other health equity issues.

The European Commission school fruit and vegetable scheme includes support for food provision and also for educational activities. A review of the scheme suggested that children learnt from the scheme and transferred the messages home. The report added that for a third of children the messages were already understood at home (mostly higher-educated families) and that the greatest change in attitudes and home consumption behaviour were found among lower-educated families and families in rural areas (European Commission, 2022).

e) Household-level acceptability of intervention

Finding: Depends on cost and attractiveness, and parental involvement in adopting changes

Changes to school food menus may affect children's willingness to participate, potentially requiring parents to make meals for the child to take to school, or cash so the child can eat outside the school. Failing to provide an attractive and low-cost menu may increase health inequity. One study noted: *'School nutrition initiatives need to involve the parents and have access to sufficient financial and human resource support'* (Downs at al 2012, p 114).

f) Household-level perceived priority

Finding: No evidence on whether food procurement is differentially prioritised

No evidence was found to show whether households view food procurement policies differentially by socio-economic subgroup.

4. Sustainability of response

a) Compatibility with community and cultural environment

Finding: No clear evidence of differential compatibility

As noted above, some communities may resist improved 'healthier' school meals and undermine the delivery of better food procurement. It is not clear of there is a social gradient or differential in this resistance, and therefore how it may affect health equity.

b) Voluntary vs regulatory

Finding: Improved standards likely to be mandatory

The standards are likely to be set at regional or national level, but implementation may be at the discretion of the institutions. There appears to be no evidence on whether this has differential socio-economic implications.

c) Barriers/threats to policy maintenance

Finding: Price and attractiveness may affect sustainability

Evidence of sustainability appears to be weak. The provision of free fruit and vegetables leads to greater consumption but the dietary improvements may be lost when the programme ceases. A study of a UK free school fruit and vegetable programme for children 5-6 years old found that consumption of fruit and vegetables was sustained in children up to seven months following the programme, but that consumption returned to baseline in a year (Ransley et al 2007). No data were provided on differential response by socio-economic background.

Table 3.6. Summary table for evidence of health equity impact of food procurement

Source of inequity	Assessment criteria	Summary of evidence
Pre-occurring risk	Underlying health or diet differences	Evidence of greatest need among lower SES groups
	Vulnerability or susceptibility	Price sensitivity and resistance to change may be higher in low SES groups.
	General exposure to potential obesogen	Exposure to poor food procurement may show a socio-economic gradient
	Targeted exposure to potential obesogen	No evidence of deliberate targeting of socio-economic subgroups.
Reach and type of policy or intervention	Reach across subgroups/gradient	Limited evidence of reach across all groups: likely universal and proportionate.
	Degree of penetration within sub-groups	Limited evidence that improved food standards reach all within subgroups.
	Localised (micro) or widespread (macro)	Both: localised practices and national standards
	Is it upstream or downstream?	Primarily upstream with potential to improve health equity
	Reach of supportive messaging	No evidence of differential reach of messaging
	Access to supportive services	Potential differential access to supportive services
Response to intervention	Agency- or structure-led behaviour change	Structure-led with some limited agency
	Resource requirements	Costs may act as a disincentive

	Skills, literacy and numeracy requirements	No skills, literacy or numeracy is required
	School-to-home transfer of behaviour changes	Mixed evidence of school-home relations
	Household-level acceptability of intervention	Depends on cost and attractiveness, and parental involvement in adopting new standards
	Household-level perceived priority	No evidence on whether food procurement is differentially prioritised
Sustainability of response	Compatibility with community and cultural environment	No clear evidence of differential compatibility
	Voluntary vs regulatory	Improved standards likely to be mandatory
	Barriers/threats to policy maintenance	Price and attractiveness may affect sustainability
		Health equity increases, especially with mandatory procurement standards

4. Discussion: key elements for assessing best practice policies for their impact on health inequalities

The results of the first literature review provided a set of criteria that can be used to evaluate the health equity impact of policies designed to improve nutrition and food security and prevent diet-related disease. From the review, a number of specific questions can be proposed to assess equity impact, grouped within four key areas of concern:

1) Underlying inequities in exposure to risk (pre-existing health inequity, susceptibility to risk, exposure to risk).
2) Reach and type of an intervention (reach across and penetration into all subgroups, localisation, upstream/downstream, reach of and access to supportive measures).
3) Response to an intervention (agency-led or structure-led behaviour change, requirements for skills and resources, transfer from school to home, home-level acceptability and priority).
4) Response sustainability (community compatibility, regulatory support, presence of threats).

Following this, three reviews were undertaken to apply these criteria to the Best-ReMaP areas of concern: (a) policies to restrict children's exposure to the promotional marketing of unhealthy foods and beverages, (b) policies and interventions for food and beverage reformulation, and (c) policies and interventions to improve food procurement for public institutions (especially schools).

The reviews found the following (summarised in Table 4.1, below).

1) Underlying inequities in exposure to risk

For all three policy areas the underlying health inequity indicated greatest need was likely to be found in those in the least affluent families and neighbourhoods, both in terms of dietary patterns and obesity and diet-related disease status. Susceptibility to advertising messaging was greater among lower SES children, and susceptibility to pricing differentials for reformulated products and high-standard catering menus might affect lower SES consumers. Exposure to food marketing was higher for lower SES children, and while exposure to un-reformulated foods and low-standard catering was proportional to their consumption, in the case of free or subsidised catering this might specifically affect lower SES clients.

2) Reach and type of an intervention

Marketing restrictions were expected to reach across all SES groups, while reformulated products and high-standard catering would reach all those in proportion to their consumption. Product pricing might affect take-up by lower-income consumers, and some transfer to non-reformulated products, or to alternative catering outlets, may occur, including in lower SES groups. Interventions were considered to be upstream and widespread, although improved food procurement might be localised. Access to support was not considered an issue for the target groups, but the requirement to re-train catering staff may affect schools differentially according to their resources.

3) Response to an intervention

All three policies and interventions were primarily structure-led (requiring no conscious choices) although non-mandatory reformulation may lead to reformulated products competing with the original version, creating price differentials and/or the need to understand nutrition labels. Similarly, improved food procurement may lead to menu choices that allow continued unhealthy choices. The three policies did not depend on personal skills, literacy or numeracy, apart from label and menu reading. Transfer from school to home was likely to improve health equity, while there was no evidence that acceptability or priority for a household would widen inequities.

4) Response sustainability

All three interventions were considered to be compatible with community and cultural standards. Regulatory support was considered significant for all three policies: there is evidence that voluntary marketing restrictions and voluntary reformulation are significantly less effective than measures required by mandatory regulation or the threat of it. Catering standards may be set by central authority but may be undermined by lack of resources at local level. The presence of threats to policies are primarily driven by commercial interests.

In conclusion, all three policies are more likely than not to reduce inequities in health, including inequities in obesity and diet-related disease. However, in all three policy areas there are limitations to this statement:

(a) the application of marketing restrictions in one media platform can be undermined by unrestricted advertising at other times or on other platforms, including social media;
(b) the reformulation of less healthy foods and beverages needs to be supported by regulation or regulatory threats, to be monitored and to affect a wide range of products, without increasing the price for the healthier product or requiring consumers to read labels;
(c) improved food procurement and higher catering standards need to be fully funded, including for staff training and equipment, the menus attractive, and the food presented in attractive environments.

In order to overcome barriers and threats to any of the three policy areas, a programme of public health messaging, e.g. with celebrity endorsement and civil society support, can help to make regulations acceptable to the public and less of a challenge to politicians.

Lastly, it can be seen in this literature review that the evidence base has gaps and relies in some cases on the experience of a single country. Given the resistance that may be faced to implementing regulatory changes, member states will benefit from acting together through joint actions to strengthen the evidence and refine the nature and extent of policy proposals.

Table 4.1 next page

Table 4.1 Summary of evidence for the health equity impact of three policy interventions

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
Pre-occurring risk	Underlying health or diet differences	Does one group eat a less healthy diet (e.g. more salt)? Would they benefit more from change?	Evidence of greatest need among lower SES children	Evidence of greatest need among lower SES groups	Evidence of greatest need among lower SES groups
	Vulnerability or susceptibility	Is one group more responsive to advertising? Or to price modification?	Some evidence of greater vulnerability in lower-SES children.	Price sensitivity may disadvantage lower-income households.	Price sensitivity and resistance to change may be higher in low SES groups.
	General exposure to potential hazard	Is one group more exposed to TV advertising?	Evidence of greater exposure in lower SES groups	Exposure is proportional to purchase across all groups	Exposure to poor food procurement may show a socio-economic gradient
	Targeted exposure to potential hazard	Is one group more dependent on social food provision? Is TV advertising targeted at sub-groups?	Evidence of targeting of lower-income or minority groups.	Targeted promotion may increase low SES exposure	No evidence of deliberate targeting of socio-economic subgroups.
Reach and type of policy or intervention	Reach across subgroups/gradient	Do public health initiatives reach all groups? Are there language issues?	Reach in proportion to exposure: universal and proportionate.	Mandatory reformulation likely to be universal and proportionate.	Limited evidence of reach across all groups: likely universal and proportionate.

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
	Degree of penetration within sub-groups	Within poorer groups, are homeless people reached? Or adolescents after leaving home?	No evidence found.	No evidence found.	Limited evidence that improved food standards reach all within subgroups.
	Localised (micro) or widespread (macro)	Is the policy local or national? Are reformulated foods available in all shops?	At both levels interventions would improve health equity	Macro, affecting all consumers of the specific products	Both: localised practices and national standards
	Is it upstream or downstream?	Does the policy target upstream (e.g. food companies) or downstream (consumers)?	Upstream: likely to improve health equity.	Upstream: Likely to improve health equity	Primarily upstream with potential to improve health equity
	Reach of supportive messaging	Do health messages in support of reformulation regulations reach all groups?	No evidence found.	Possibly greater reach in higher income groups	No evidence of differential reach of messaging
	Access to supportive services	Do welfare food vouchers reach all those in need?	No evidence found.	No evidence found	Potential differential access to supportive services
Response to intervention	Agency- or structure-led behaviour change	Does the policy require individual voluntary changes in behaviour? Is the healthier choice the easier choice?	Structure-led: likely to improve health equity	Mandatory reformulation is a structure-led intervention	Structure-led with some limited agency
	Resource requirements	Does behaviour change require financial, time or equipment	No resource requirements for individuals. (Low costs to media platforms, potential	Resource requirements if there are price differentials	Costs may act as a disincentive

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
		resources? Are reformulated products more expensive?	savings to advertisers, low cost to public finances.)		
	Skills, literacy and numeracy requirements	Does behaviour change require skills to implement? Do food labels need literacy or numeracy skills?	No personal skills, literacy or numeracy required.	Choice may require literacy or numeracy	No skills, literacy or numeracy is required
	School-to-home transfer of behaviour changes	Do school-based programmes to drink water or eat fruit transfer easily to the home environment?	No school-to-home transfer required	No school-to-home transfer required	Mixed evidence of school-home relations
	Household-level acceptability of intervention	Are behaviour changes suitable for all cultures? What about periods of fasting?	No evidence of differential acceptability.	Some resistance to reformulated products	Depends on cost and attractiveness, and parental involvement in adopting new standards
	Household-level perceived priority	Is the behaviour change competing with other priorities? Are all members of a household motivated?	No evidence of differential perceived priority.	No evidence of differential perceived priority	No evidence on whether food procurement is differentially prioritised
Sustainability of response	Compatibility with community and cultural environment	Are policies in concordance with existing dietary patterns and food supply environments? Are fast food outlets undermining a policy?	No evidence for differential compliance	No evidence of community incompatibility.	No clear evidence of differential compatibility

Source of inequity	Assessment criteria	Examples of evidence needs	Summary of evidence: marketing restrictions	Summary of evidence: reformulation	Summary of evidence: procurement standards
	Voluntary vs regulatory	Does the policy have statutory support? Can it be ignored in some areas, or reversed easily?	Regulatory implementation likely improves health equity	Mandatory reformulation maximises health equity improvement	Improved standards likely to be mandatory
	Barriers/threats to policy maintenance	What might undo the policy? Is this more likely in some communities or sub-groups?	Commercial resistance could widen health inequity.	Commercial interests may undermine equity benefits of reformulation	Price and attractiveness may affect sustainability
			Health equity increases, especially with strong regulatory implementation	**Health equity increases, especially with mandatory implementation**	**Health equity increases, especially with mandatory procurement standards**

References

Text reference	Full references
Adams et al 2009	Socio-economic and gender differences in nutritional content of foods advertised in popular UK weekly magazines. Adams J, White M. Eur J Public Health. 2009;19(2):144-9.
Adams et al 2012	Socio-economic differences in exposure to television food advertisements in the UK: a cross-sectional study of advertisements broadcast in one television region. Adams J, Tyrrell R, Adamson AJ, White M. Public Health Nutr. 2012;15(3):487-94.
Adams, Ganti et al 2011	Socio-economic differences in outdoor food advertising in a city in Northern England. Adams J, Ganiti E, White M. Public Health Nutr. 2011;14(6):945-50.
Adams, Simpson et al 2011	Variations in food and drink advertising in UK monthly women's magazines according to season, magazine type and socio-economic profile of readers: a descriptive study of publications over 12 months. BMC Public Health. Adams J, Simpson E, White M. 2011;11:368.
Ahrens et al 2022	Dietary behaviour and physical activity policies in Europe: learnings from the Policy Evaluation Network (PEN). Ahrens W, Brenner H, Flechtner-Mors M, Harrington JM, Hebestreit A, Kamphuis CBM, Kelly L, Laxy M, Luszczynska A, Mazzocchi M, Murrin C, Poelman MP, Steenhuis I, Roos G, Steinacker JM, van Lenthe F, Zeeb H, Zukowska J, Lakerveld J, Woods CB. Eur J Public Health. 2022;32(Suppl 4):iv114-iv125.
Al-Jawaldeh et al 2022	Sugar Reduction Initiatives in the Eastern Mediterranean Region: A Systematic Review. Al-Jawaldeh A, Taktouk M, Naalbandian S, Aguenaou H, Al Hamad N, Almamary S, Al-Tamimi HA, Alyafei SA, Barham R, Hoteit M, Hussain M, Massad H, Nasreddine L. Nutrients. 2022;15(1):55.
Arumugam 2011	Campbell Soup increases sodium as new studies vindicate salt. Arumugam N. Forbes, 18th July 2011. https://www.forbes.com/sites/nadiaarumugam/2011/07/18/campbell-soup-increases-sodium-as-new-studies-vindicate-salt/

Text reference	Full references
Backholer and Peeters 2017	The utility of the agency-structure framework to estimate the health equity impact of universal obesity prevention policies. Backholer K, Peeters A. Obes Rev. 2017;18(1):126-128.
Backholer et al 2014	A framework for evaluating the impact of obesity prevention strategies on socioeconomic inequalities in weight. Backholer K, Beauchamp A, Ball K, Turrell G, Martin J, Woods J, Peeters A. Am J Public Health. 2014;104(10):e43-50.
Backholer et al 2021	Differential exposure to, and potential impact of, unhealthy advertising to children by socio-economic and ethnic groups: A systematic review of the evidence. Backholer K, Gupta A, Zorbas C, Bennett R, Huse O, Chung A, Isaacs A, Golds G, Kelly B, Peeters A. Obes Rev. 2021;22(3):e13144.
Barberio et al 2017	Population-level interventions in government jurisdictions for dietary sodium reduction: a Cochrane Review. Barberio AM, Sumar N, Trieu K, Lorenzetti DL, Tarasuk V, Webster J, Campbell NRC, McLaren L. Int J Epidemiol. 2017;46(5):1551-1405.
Baum et al 2016	Assessing the health impact of transnational corporations: its importance and a framework. Baum FE, Sanders DM, Fisher M, Anaf J, Freudenberg N, Friel S, Labonté R, London L, Monteiro C, Scott-Samuel A, Sen A. Global Health. 2016;12(1):27.
Beauchamp et al 2014	The effect of obesity prevention interventions according to socioeconomic position: a systematic review. Beauchamp A, Backholer K, Magliano D, Peeters A. Obes Rev. 2014;15(7):541-54.
Boelsen-Robinson et al 2015	A systematic review of the effectiveness of whole-of-community interventions by socioeconomic position. Boelsen-Robinson T, Peeters A, Beauchamp A, Chung A, Gearon E, Backholer K. Obes Rev. 2015;16(9):806-16.
Boylan et al 2011	Socio-economic circumstances and food habits in Eastern, Central and Western European populations. Boylan S, Lallukka T, Lahelma E, Pikhart H, Malyutina S, Pajak A, Kubinova R, Bragina O, Stepaniak U, Gillis-Januszewska A, Simonova G, Peasey A, Bobak M. Public Health Nutr. 2011;14(4):678-87.

Text reference	Full references
Boyland et al 2022	Association of Food and Nonalcoholic Beverage Marketing With Children and Adolescents' Eating Behaviors and Health: A Systematic Review and Meta-analysis. Boyland E, McGale L, Maden M, Hounsome J, Boland A, Angus K, Jones A. JAMA Pediatr. 2022;176(7):e221037.
Brown et al 2018	The Potential Cost-Effectiveness and Equity Impacts of Restricting Television Advertising of Unhealthy Food and Beverages to Australian Children. Brown V, Ananthapavan J, Veerman L, Sacks G, Lal A, Peeters A, Backholer K, Moodie M. Nutrients. 2018;10(5):622.
Brug et al 2012	Differences in weight status and energy-balance related behaviors among schoolchildren across Europe: the ENERGY-project. Brug J, van Stralen MM, Te Velde SJ, Chinapaw MJ, De Bourdeaudhuij I, Lien N, Bere E, Maskini V, Singh AS, Maes L, Moreno L, Jan N, Kovacs E, Lobstein T, Manios Y. PLoS One. 2012;7(4):e34742.
Bucher Della Torre et al 2022	Impact of Measures Aiming to Reduce Sugars Intake in the General Population and Their Implementation in Europe: A Scoping Review. Bucher Della Torre S, Moullet C, Jotterand Chaparro C. Int J Public Health. 2022;66:1604108.
Buijzen et al 2008	Associations between children's television advertising exposure and their food consumption patterns: a household diary-survey study. Buijzen M, Schuurman J, Bomhof E. Appetite. 2008;50(2-3):231-9.
Campos et al 2011	Nutrition labels on pre-packaged foods: a systematic review. Campos S, Doxey J, Hammond D. Public Health Nutr. 2011;14(8):1496-506.
Canadian Public Health Authority 2020	Canadian Public Health Authority. Health Equity Impact Assessment. January 2020. https://cpha.ca/policy-statement-health-equity-impact-assessment
Chambers et al 2015	Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: A systematic review of the evidence from statutory and self-regulatory actions and educational measures. Chambers SA, Freeman R, Anderson AS, MacGillivray S. Prev Med. 2015;75:32-43.

Text reference	Full references
Coleman et al 2022	A rapid review of the evidence for children's TV and online advertisement restrictions to fight obesity. Coleman PC, Hanson P, van Rens T, Oyebode O. Prev Med Rep. 2022;26:101717.
CSPI 2021	Food Marketing to Kids: Targeted Marketing. Washington DC: Center for Science in the Public Interest, 2021. https://www.cspinet.org/advocacy/nutrition/food-marketing-kids
D'Angelo et al 2020	Food consumption in the UK: Trends, attitudes and drivers. D'Angelo C, Gloinson ER, Draper A, Guthrie S. Cambridge: Rand Europe, 2020. https://www.rand.org/content/dam/rand/pubs/research_reports/RR4300/RR4379/RAND_RR4379.pdf
DDHSC 2021	Department for Health and Social Care and Department for Digital Culture Media and Sport. Equality assessment: introducing further advertising restrictions on TV and online for products high in fat, salt and sugar. Consultation outcome. London: UK Government, 24 June 2021. https://www.gov.uk/government/consultations/further-advertising-restrictions-for-products-high-in-fat-salt-and-sugar/outcome/equality-assessment-introducing-further-advertising-restrictions-on-tv-and-online-for-products-high-in-fat-salt-and-sugar#summary-of-the-effects-of-the-policy-on-people-with-protected-characteristics
Dens et al 2007	Parental attitudes towards advertising to children and restrictive mediation of children's television viewing in Belgium. Dens N, De Pelsmacker P, Eagle L. Young Consumers, 2007;8(1):7-18.
Department of Health for Ireland. 2021	Ministers Donnelly and Feighan announce significant plans to reduce levels of salt, sugar, saturated fats and calories in processed foods. Press Release. Dublin: Department of Health, 2021.
Dewidar et al 2020	Over half of the WHO guidelines published from 2014 to 2019 explicitly considered health equity issues: a cross-sectional survey. Dewidar O, Tsang P, León-García M, Mathew C, Antequera A, Baldeh T, Akl EA, Alonso-Coello P, Petkovic J, Piggott T, Pottie K, Schünemann H, Tugwell P, Welch V J Clin Epidemiol. 2020;127:125-133.
Downs et al 2012	From paper to practice: barriers to adopting nutrition guidelines in schools. Downs SM, Farmer A, Quintanilha M, Berry TR, Mager DR, Willows ND, McCargar LJ. J Nutr Educ Behav. 2012;44(2):114-22.

Text reference	Full references
Dubuisson et al 2011	Socio-economic and demographic variations in school lunch participation of French children aged 3-17 years. Dubuisson C, Lioret S, Dufour A, Calamassi-Tran G, Volatier JL, Lafay L, Turck D. Public Health Nutr. 2011;14(2):227-38.
EPHA 2019	Discussion paper: Public procurement for sustainable food environments. Brussels: European Public Health Alliance, 2019. https://epha.org/public-procurement-for-sustainable-food-environments/
Escaron et al 2019	RE-AIM analysis of a community-partnered policy, systems, and environment approach to increasing consumption of healthy foods in schools serving low-income populations. Escaron AL, Martinez C, Vega-Herrera C, Enger SM. Transl Behav Med. 2019;9(5):899-909.
European Commission 2015	Report from the Commission to the European Parliament and the Council regarding trans fats in foods and in the overall diet of the Union population COM(2015) 619 final. Brussels: European Commission, 2015.
European Commission 2017	Food product reformulation by a supermarket chain (Albert Heijn) in the Netherlands. Brussels: Health Equity Pilot Project (HEPP). Brussels: European Commission, 2017. https://health.ec.europa.eu/publications/food-product-reformulation-supermarket-chain-albert-heijn-netherlands_en
European Commission 2022	School scheme by country. Brussels: European Commission, DG Agriculture and Rural Development, 2023. https://agriculture.ec.europa.eu/common-agricultural-policy/market-measures/school-fruit-vegetables-and-milk-scheme/country_en
European Commission 2023	Evaluation support study of the EU school fruit, vegetables and milk scheme. Executive summary. Brussels: European Commission, 2022. https://op.europa.eu/en/publication-detail/-/publication/85551627-6a2a-11ed-b14f-01aa75ed71a1
Eurostat 2019	Eurostat 2019 survey database. https://ec.europa.eu/eurostat/web/main/data/database
Federici et al 2019	The impact of food reformulation on nutrient intakes and health, a systematic review of modelling studies. Federici C, Detzel P, Petracca F, Dainelli L, Fattore G. BMC Nutr. 2019;5:2.

Text reference	Full references
Feteira-Santos et al 2021	Looking Ahead: Health Impact Assessment of Front-Of-Pack Nutrition Labelling Schema as a Public Health Measure. Feteira-Santos R, Alarcão V, Santos O, Virgolino A, Fernandes J, Vieira CP, João Gregório M, Nogueira P, Costa A, Graça P. Int J Environ Res Public Health. 2021;18(4):1422.
Food Standards Agency 2018	Northern Ireland consumer perceptions of reformulation of food. London: Food Standards Agency, 2018. https://www.food.gov.uk/sites/default/files/media/document/ni-consumer-perceptions-of-food-reformulation.pdf
Galbraith-Emami and Lobstein 2013	The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. Galbraith-Emami S, Lobstein T. Obes Rev, 2013;14(12):960-74.
Gillespie et al 2015	The Health Equity and Effectiveness of Policy Options to Reduce Dietary Salt Intake in England: Policy Forecast. Gillespie DO, Allen K, Guzman-Castillo M, Bandosz P, Moreira P, McGill R, Anwar E, Lloyd-Williams F, Bromley H, Diggle PJ, Capewell S, O'Flaherty M. PLoS One, 2015;10(7):e0127927.
Goldblatt 2018	Scientific report on evidence based interventions to reduce socio-economic inequalities in diet and physical activity. Goldblatt P. Health Equity Pilot Project (HEPP) Evidence Review. Brussels: European Commission, 2018. https://health.ec.europa.eu/publications/scientific-report-evidence-based-interventions-reduce-socio-economic-inequalities-diet-and-physical_en
Greiger et al 2016	Discrete strategies to reduce intake of discretionary food choices: a scoping review. Grieger JA, Wycherley TP, Johnson BJ, Golley RK. Int J Behav Nutr Phys Act. 2016;13:57.
Greisser, Sassi et al 2021	Contribution of reformulation, product renewal, and changes in consumer behavior to the reduction of salt intakes in the UK population between 2008/2009 and 2016/2017. Gressier M, Sassi F, Frost G. Am J Clin Nutr. 2021;114(3):1092-1099.
Gressier et al 2020	Success of reformulation and health education in reducing sodium intakes across socioeconomic groups. M Gressier, G Frost, F Sassi. European Journal of Public Health 2020;30 Supp 5.

Text reference	Full references
Gressier, Swinburn et al 2021	What is the impact of food reformulation on individuals' behaviour, nutrient intakes and health status? A systematic review of empirical evidence. Gressier M, Swinburn B, Frost G, Segal AB, Sassi F. Obes Rev. 2021;22(2):e13139.
Griffith et al 2014	Product reformulation effective in reducing dietary salt intake. Griffith R, O'Connell M, Smith K. London: Institute for Fiscal Studies, 2014. https://ifs.org.uk/articles/product-reformulation-effective-reducing-dietary-salt-intake
Griffith et al 2019	The potential impacts of banning television advertising of HFSS food and drink before the watershed. Griffith R, O'Connell M, Smith K, Stroud R. London: Institute for Fiscal Studies: 2019. https://ifs.org.uk/publications/potential-impacts-banning-television-advertising-hfss-food-and-drink-watershed
Gubbels et al 2015	The assessment of ongoing community-based interventions to prevent obesity: lessons learned. Gubbels JS, Mathisen FK, Samdal O, Lobstein T, Kohl LF, Leversen I, Lakerveld J, Kremers SP, van Assema P. BMC Public Health. 2015;15:216.
Gunter 2012	A series of questions to analyse equity in the policy Health Impact Assessment process. (Revised draft following HIA training Nov 2011). Gunter S. Annex 2 of Learning from Equity Action Health Impact Assessment (Processing and Training), Equity Action, 2012. https://health-inequalities.eu/wp-content/uploads/2021/01/Learning_from_equity_Action_Health_impact_Assessment_and_equity.pdf
Hall et al 2016	Policy Approaches to Advancing Health Equity. Hall M, Graffunder C, Metzler M. J Public Health Manag Pract. 2016;22 Suppl 1:S50-9.
Hampshire County Council undated	Spend less on your weekly shop with a free school lunch. Hampshire County Council Catering Services (HC3S), undated. https://www.hants.gov.uk/educationandlearning/hc3s/education-catering/primary
Harris et al 2022	Targeted food and beverage advertising to Black and Hispanic consumers: 2022 update. Harris JL, Fleming-Milici F, Mancini S, Kumanyika S, Ramirez AG. Rudd Report. Hartford: UConn Rudd Center for Food Policy and Health, University of Connecticut, 2022. https://uconnruddcenter.org/targetedmarketing2022/

Text reference	Full references
He et al 2014	Salt reduction in the United Kingdom: a successful experiment in public health. He FJ, Brinsden HC, MacGregor GA. J Hum Hypertens. 2014;28(6):345-52.
Hess et al 2012	The role of health-related, motivational and sociodemographic aspects in predicting food label use: a comprehensive study. Hess R, Visschers VH, Siegrist M. Public Health Nutr. 2012;15(3):407-414.
Hutchinson et al 2018	Comparison of high and low trans-fatty acid consumers: analyses of UK National Diet and Nutrition Surveys before and after product reformulation. Hutchinson J, Rippin HL, Jewell J, Breda JJ, Cade JE. Public Health Nutr. 2018;21(3):465-479.
Hyesini, Elliot-Green et al 2017	Systematic review of dietary salt reduction policies: Evidence for an effectiveness hierarchy? Hyseni L, Elliot-Green A, Lloyd-Williams F, Kypridemos C, O'Flaherty M, McGill R, Orton L, Bromley H, Cappuccio FP, Capewell S. PLoS One. 2017;12(5):e0177535.
Hyseni, Atkinson et al 2017	The effects of policy actions to improve population dietary patterns and prevent diet-related non-communicable diseases: scoping review. Hyseni L, Atkinson M, Bromley H, Orton L, Lloyd-Williams F, McGill R, Capewell S. Eur J Clin Nutr. 2017;71(6):694-711.
ICF 2022	EU REformulation MOnitoring (EUREMO) Feasibility study for a monitoring system on reformulation initiatives for salt, sugars and fat: Final Report. ICF sa. Brussels: European Commision – European Health and Digital Executive Agency (HaDEA), 2022.
IEA 2020	IEA. Food reformulation by stealth designed to please Public Health England, not consumers, says new IEA report. London: Institute for Economic Affairs, 16 Aug 2019. https://iea.org.uk/media/food-reformulation-by-stealth-designed-to-please-public-health-england-not-consumers-says-new-iea-report/
Inchley et al 2020	Spotlight on adolescent health and well-being. Findings from the 2017/2018 Health Behaviour in School-aged Children (HBSC) survey in Europe and Canada. International report. Volume 2. Key data. Inchley J, Currie D, Budisavljevic S, Torsheim T, Jåstad A, Cosma A, Kelly C, Arsaell MA, Barnekow V, Weber MM, editors. Copenhagen: WHO Regional Office for Europe; 2020.

Text reference	Full references
IPH 2016	IPH. Health Impact Assessment Guidance: A Manual. Dublin: Institute of Public Health, 2022. https://publichealth.ie/hia/guidance.pdf
JAHEE 2020	Deliverable 9.1 Policy Framework for Action. Work Package 9: Health and Equity in All Policies – Governance. Joint Action – Health Equity Europe (JAHEE), 2020. https://jahee.iss.it/wp-content/uploads/2020/12/D9.1-WP9-PFA.pdf
Ji and Cappuccio 2014	Socioeconomic inequality in salt intake in Britain 10 years after a national salt reduction programme. Ji C, Cappuccio FP. BMJ Open. 2014; 4: e005683
Kelly et al 2021	Australian Children's Exposure to, and Engagement With, Web-Based Marketing of Food and Drink Brands: Cross-sectional Observational Study. Kelly B, Bosward R, Freeman B. J Med Internet Res. 2021;23(7):e28144.
Kent et al 2022	Evidence synthesis – Benchmarking unhealthy food marketing to children and adolescents in Canada: a scoping review. Kent MP, Hatoum F, Wu D, Remedios L, Bagnato M. Health Promotion and Chronic Disease Prevention in Canada,, 2022;42(8):307-318.
Kickbusch et al 2016	The commercial determinants of health. Kickbusch I, Allen L, Franz C. Lancet Glob Health. 2016;4(12):e895-e896.
Klepp et al 2007	Television viewing and exposure to food-related commercials among European school children, associations with fruit and vegetable intake: a cross sectional study. Klepp K-I, Wind M, de Bourdeaudhuij I, Rodrigo CP, Due P, Bjelland M, Brug J. Int J Behav Nutr Phys Act. 2007;4:46.
Kumanyika 2017	Getting to Equity in Obesity Prevention: A New Framework. Kumanyika S. Washington DC: National Academy of Medicine Discussion Paper, January 18, 2017. https://nam.edu/getting-to-equity-in-obesity-prevention-a-new-framework/
Lake 2021	Cited in 'Historic reforms needed to build a better food system to improve national health'. Lake A. Fuse, 15th July 2021. Newcastle: Centre for Translational Research in Public Health, 2021. http://www.fuse.ac.uk/news/historicreformsneededtobuildabetterfoodsystemtoimprovenationalhealth.html

Text reference	Full references
Lakerveld et al 2012	Sustainable prevention of obesity through integrated strategies: The SPOTLIGHT project's conceptual framework and design. Lakerveld J, Brug J, Bot S, Teixeira PJ, Rutter H, Woodward E, Samdal O, Stockley L, De Bourdeaudhuij I, van Assema P, Robertson A, Lobstein T, Oppert JM, Adány R, Nijpels G; SPOTLIGHT consortium. BMC Public Health. 2012;12:793.
Landwehr and Hartmann 2020	Industry Self-Regulation of Food Advertisement to Children: Compliance versus Effectiveness of the EU Pledge. Landwehr, SC, and Hartmann, M. Food Policy 2020;91:101833.
Lehmann et al 2021	Nutrient profiling for product reformulation: public health impact and benefits for the consumer. Lehmann U, Charles VR, Vlassopoulos A, Masset G, Spieldenner J. Proc Nutr Soc. 2017;76(3):255-264.
Ligaya 2012	Food Fight: High School Students Lobby to Bring Back Pizza, Coffee and Chocolate. Ligaya, A. Toronto: National Post, 8th May 2012. https://nationalpost.newspapers.com/image/514513984/?terms=Ligaya%20AND%20pizza
Lobstein 2014	Diet, Nutrition and Obesity. Task 1. Evidence, Research and Economic Analysis of Nutrition, Obesity and Health Inequalities. Lobstein T. Papers produced for the Health Inequalities Audit Process – Equity Action. Brussels: Health Equity, 2014. https://1drv.ms/b/s!AigZubAnDvQWdAkc_uOmZmStw0c?e=jCnkeK
Lobstein 2015	Inequalities and obesity: Evidence and gaps. Lobstein T. Presentation on behalf of Equity Action to the Twenty-second plenary meeting of the High Level Group on Nutrition and Physical Activity, European Commission, Brussels, February 18, 2015. https://health.ec.europa.eu/latest-updates/presentations-twenty-second-plenary-meeting-high-level-group-nutrition-and-physical-activity-18-2015-02-20_en
Lobstein 2017	The impact of interventions and policies on SES differentials in obesity and diet. Lobstein T. Health Equity Pilot Project (HEPP) Evidence Review. Brussels: European Commission, 2017. https://health.ec.europa.eu/document/download/3dc7a3ce-c584-40d5-ae48-40b458dd1e6e_en?filename=hepp_screport_nutrition_b1000days_en.pdf
Lobstein 2023	Social disparities in child obesity in Europe are getting worse. Lobstein T. Online report of the STOP Project, World Obesity Federation, 2023. https://www.worldobesity.org/news/social-disparities-in-child-obesity-a-report-from-the-stop-project

Text reference	Full references
Lobstein and Neveux 2012	Deliverable D4.1a A review of systematic reviews of the impact on children of three population-wide policies; Deliverable D4.1b A systematic review of the impact of three population-wide policies on socio-economic disparities in child obesity. Lobstein T, Neveux M. EU STOP Project. Imperial College London, 2021. https://www.stopchildobesity.eu/wp-content/uploads/2021/10/D4.1.pdf
Lobstein et al 2020	Costs, equity and acceptability of three policies to prevent obesity: A narrative review to support policy development. Lobstein T, Neveux M, Landon J. Obes Sci Pract. 2020;6(5):562-583.
Lorenc et al 2013	What types of interventions generate inequalities? Evidence from systematic reviews. Lorenc T, Petticrew M, Welch V, Tugwell P. J Epidemiol Community Health. 2013;67(2):190-3.
Loring and Robertson 2014	Obesity and inequities. Guidance for addressing inequities in overweight and obesity. Loring B, Robertson A. Copenhagen: World Health Organization, 2014.
Løvhaug et al 2022	The potential of food environment policies to reduce socioeconomic inequalities in diets and to improve healthy diets among lower socioeconomic groups: an umbrella review. Løvhaug AL, Granheim SI, Djojosoeparto SK, Harrington JM, Kamphuis CBM, Poelman MP, Roos G, Sawyer A, Stronks K, Torheim LE, Twohig C, Vandevijvere S, van Lenthe FJ, Terragni L. BMC Public Health. 2022;22(1):433.
Madre and Guala 2022	EU School food procurement schemes. Madre Y, Guala G. Farm Europe website, 29/09/2022. https://www.farm-europe.eu/news/eu-school-food-procurement-schemes/
Magnée et al 2013	Equity-specific effects of 26 Dutch obesity-related lifestyle interventions. Magnée T, Burdorf A, Brug J, Kremers SP, Oenema A, van Assema P, Ezendam NP, van Genugten L, Hendriksen IJ, Hopman-Rock M, Jansen W, de Jong J, Kocken PL, Kroeze W, Kwak L, Lechner L, de Nooijer J, van Poppel MN, Robroek SJ, Schreurs H, van Sluijs EM, Steenhuis IJ, van Stralen MM, Tak NI, te Velde SJ, Vermeer WM, Wammes B, van Wier MF, van Lenthe FJ. Am J Prev Med. 2013;44(6):e57-66.

Text reference	Full references
Marklund et al 2020	Estimated health benefits, costs, and cost-effectiveness of eliminating industrial trans-fatty acids in Australia: A modelling study. Marklund M, Zheng M, Veerman JL, Wu JHY. PLoS Med. 2020;17(11):e1003407.
Marmot et al 2008	Closing the gap in a generation: health equity through action on the social determinants of health. Marmot M, Friel S, Bell R, Houweling TA, Taylor S; Commission on Social Determinants of Health. Lancet. 2008;372(9650):1661-9.
Mayén et al 2016	Interventions promoting healthy eating as a tool for reducing social inequalities in diet in low- and middle-income countries: a systematic review. Mayén AL, de Mestral C, Zamora G, Paccaud F, Marques-Vidal P, Bovet P, Stringhini S. Int J Equity Health. 2016;15(1):205.
McGill et al 2015	Are interventions to promote healthy eating equally effective for all? Systematic review of socioeconomic inequalities in impact. McGill R, Anwar E, Orton L, Bromley H, Lloyd-Williams F, O'Flaherty M, Taylor-Robinson D, Guzman-Castillo M, Gillespie D, Moreira P, Allen K, Hyseni L, Calder N, Petticrew M, White M, Whitehead M, Capewell S. BMC Public Health. 2015;15:457.
McLaren et al 2016	Population-level interventions in government jurisdictions for dietary sodium reduction. McLaren L, Sumar N, Barberio AM, Trieu K, Lorenzetti DL, Tarasuk V, Webster J, Campbell NRC. Cochrane Database of Systematic Reviews 2016;9:CD010166.
Msora-Kasago 2020	Understanding and Promoting Nutrition and Health Equity. Msora-Kasago C. Food and Nutrition, September 11, 2020. https://foodandnutrition.org/from-the-magazine/understanding-and-promoting-nutrition-and-health-equity/
Mytton et al 2020	The potential health impact of restricting less-healthy food and beverage advertising on UK television between 05.30 and 21.00 hours: A modelling study. Mytton OT, Boyland E, Adams J, Collins B, O'Connell M, Russell SJ, Smith K, Stroud R, Viner RM, Cobiac LJ. PLoS Med. 2020;17(10):e1003212.
Najkaruma et al 2015	Price promotions on healthier compared with less healthy foods: a hierarchical regression analysis of the impact on sales and social patterning of responses to promotions in Great Britain. Nakamura R, Suhrcke M, Jebb SA, Pechey R, Almiron-Roig E, Marteau TM. Am J Clin Nutr. 2015;101:808-16. (Erratum in Am J Clin Nutr. 2015;102:980.)

Text reference	Full references
Neter et al 2016	Dutch food bank parcels do not meet nutritional guidelines for a healthy diet. Neter JE, Dijkstra SC, Visser M, Brouwer IA. Br J Nutr. 2016;116(3):526-33.
New Zealand Ministry of Education 2023	Ka Ora, Ka Ako / Healthy School Lunches Programme. Wellington: Te Tāhuhu o te Mātauranga / The Ministry of Education, 2023. https://www.education.govt.nz/our-work/overall-strategies-and-policies/wellbeing-in-education/free-and-healthy-school-lunches/
Ni Mhurchu et al 2013	Food prices and consumer demand: differences across income levels and ethnic groups. Ni Mhurchu C, Eyles H, Schilling C, Yang Q, Kaye-Blake W, Genç M, Blakely T. PLoS One. 2013;8(10):e75934.
Niebylski et al 2014	Healthy food procurement policies and their impact. Niebylski ML, Lu T, Campbell NR, Arcand J, Schermel A, Hua D, Yeates KE, Tobe SW, Twohig PA, L'Abbé MR, Liu PP. Int J Environ Res Public Health. 2014;11(3):2608-27.
Nisbett et al 2022	Holding no-one back: the nutrition equity framework in theory and practice. Nisbett N, Harris J, Backholer K, Baker P, Jernigan VBB, Friel S. Glob Food Secur. 2022; 32100605
Novaković et al 2014	Socio-economic determinants of micronutrient intake and status in Europe: a systematic review. Novaković R, Cavelaars A, Geelen A, Nikolić M, Altaba II, Viñas BR, Ngo J, Golsorkhi M, Medina MW, Brzozowska A, Szczecinska A, de Cock D, Vansant G, Renkema M, Majem LS, Moreno LA, Glibetić M, Gurinović M, van't Veer P, de Groot LC. Public Health Nutr. 2014;17(5):1031-45.
O'Connell et al 2022	School meals as a resource for low-income families in three European countries: a comparative case approach. O'Connell R, Brannen J, Ramos V, Skuland S, Truninger M. European Societies, 2022;24:(3):251-282.
OECD 2019	The Heavy Burden of Obesity: The Economics of Prevention. Paris: OECD, 2019. https://doi.org/10.1787/67450d67-en
Ofcom 2008	Changes in the nature and balance of television food advertising to children A review of HFSS advertising restrictions. London: Office of Communications (Ofcom), 2008.

Text reference	Full references
Ofcom 2022	Children and parents: media use and attitudes report 2022. Annex 2: Children who may be classed as vulnerable. London: Office of Communications (Ofcom), 2022. https://www.ofcom.org.uk/__data/assets/pdf_file/0024/234528/annex-2-childrens-media-use-and-attitudes-report-2022.pdf
OHID 2022a	Patterns and trends in child obesity (England data from the 2021/22 NCMP). London: Office for Health Improvement and Disparities (OHID), Public Health Analysis Directorate, 2022. https://fingertips.phe.org.uk/profile/national-child-measurement-programme/data#page/
OHID 2022b	Sugar, salt and calorie reduction and reformulation. London: Office for Health Improvement and Disparities (OHID), 2022. https://www.gov.uk/government/collections/sugar-reduction
OHID 2022c	Sugar reduction – industry progress 2015 to 2020 Including the final report for foods included in the programme and the latest data for drinks included in the Soft Drinks Industry Levy and juices and milk based drinks. London: Office for Health Improvement and Disparities (OHID), 2022. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1121444/Sugar-reduction-and-reformulation-progress-report-2015-to-2020.pdf
Olsen et al 2021	Exposure to unhealthy product advertising: Spatial proximity analysis to schools and socio-economic inequalities in daily exposure measured using Scottish Children's individual-level GPS data. Olsen JR, Patterson C, Caryl FM, Robertson T, Mooney SJ, Rundle AG, Mitchell R, Hilton S. Health Place. 2021;68:102535
Olstad et al 2016	Can policy ameliorate socioeconomic inequities in obesity and obesity-related behaviours? A systematic review of the impact of universal policies on adults and children. Olstad DL, Teychenne M, Minaker LM, Taber DR, Raine KD, Nykiforuk CI, Ball K. Obes Rev. 2016;17(12):1198-1217.
Oosterhoff et al 2020	Lifetime cost-effectiveness and equity impacts of the Healthy Primary School of the Future initiative. Oosterhoff M, Over EAB, van Giessen A, Hoogenveen RT, Bosma H, van Schayck OCP, Joore MA. BMC Public Health. 2020;20(1):1887.

Text reference	Full references
Palmer et al 2021	A deep learning approach to identify unhealthy advertisements in street view images. Palmer G, Green M, Boyland E, Vasconcelos YSR, Savani R, Singleton A. Sci Rep. 2021;11(1):4884.
Parke and Tatlow-Golden 2019	Children's exposure to digital ads for unhealthy items is underestimated: Examining the Kantar Consulting HFSS Digital Advertising Analysis in DCMS/DHSC Impact Assessment. Parke D, Tatlow-Golden M. London: Obesity Health Alliance, 2019. https://obesityhealthalliance.org.uk/wp-content/uploads/2019/06/Children%E2%80%99s-exposure-to-HFSS-ads-online-Parker-Tatlow-Golden.pdf
Partridge et al 2022	School meals will shrink without help to tackle rising costs, warns food boss. Partridge J, Butler P, Kollewe J. London: The Guardian, 17 May 2022.
Peeters and Backholer 2015	Reducing socioeconomic inequalities in obesity: the role of population prevention. Peeters A, Backholer K. Lancet Diabetes Endocrinol. 2015;3(11):838-40.
PHE 2018	Calorie reduction: The scope and ambition for action. London: Public Health England, 2018.
PHE 2019	PHE. Reduction and reformulation programme: Spring 2019 update. London: Public Health England, 2019. https://www.gov.uk/government/publications/reduction-and-reformulation-programme-spring-2019-update/reduction-and-reformulation-programme-spring-2019-update
PHE 2020	Health Equity Assessment Tool. London: Public Health England, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/989157/HEAT_full_version-ODT.odt
Powell and Chaloupka 2009	Food prices and obesity: evidence and policy implications for taxes and subsidies. Powell L, Chaloupka F. Milbank Quarterly, 2009;87:229–257.

Text reference	Full references
Powell et al 2014	Racial/ethnic and income disparities in child and adolescent exposure to food and beverage television ads across the U.S. media markets. Powell LM, Wada R, Kumanyika SK. Health Place. 2014;29:124-31.
Povall et al 2014	Health equity impact assessment. Povall SL, Haigh FA, Abrahams D, Scott-Samuel A. Health Promot Int. 2014;29(4):621-33.
Ransley et al 2007	Does the school fruit and vegetable scheme improve children's diet? A non-randomised controlled trial. Ransley JK, Greenwood DC, Cade JE, Blenkinsop S, Schagen I, Teeman D, Scott E, White G, Schagen S. J Epidemiol Community Health. 2007;61(8):699-703.
Rippin et al 2018	An exploration of socio-economic and food characteristics of high trans fatty acid consumers in the Dutch and UK national surveys after voluntary product reformulation. Rippin HL, Hutchinson J, Ocke M, Jewell J, Breda JJ, Cade JE. Food Nutr Res. 2017;61(1):1412793.
Robertson et al 2007	Obesity and socio-economic groups in Europe: Evidence review and implications for action. Robertson A, Lobstein T, Knai C. Prepared for the European Commission, (SANCO/2005/C4-NUTRITION-03), Brussels, 2007. http://ec.europa.eu/health/ph_determinants/life_style/nutrition/documents/ev20081028_rep_en.pdf
Rodriguez 2020	School Nutrition, Food Procurement, & Equitable Community Development. R Rodriguez. Oakland CA: The Praxis Project, 2020. https://www.thepraxisproject.org/resource/2020/school-nutrition-procurement-and-equitable-comm-dev
Rosewarne et al 2022	A Global Review of National Strategies to Reduce Sodium Concentrations in Packaged Foods. Rosewarne E, Santos JA, Trieu K, Tekle D, Mhurchu CN, Jones A, Ide N, Yamamoto R, Nishida C, Webster J. Adv Nutr. 2022;13(5):1820-1833.
Russell et al 2019	The effect of screen advertising on children's dietary intake: A systematic review and meta-analysis. Russell SJ, Croker H, Viner RM. Obes Rev. 2019;20(4):554-568.

Text reference	Full references
Rutter et al 2017	Balancing Upstream and Downstream Measures to Tackle the Obesity Epidemic: A Position Statement from the European Association for the Study of Obesity. Rutter H, Bes-Rastrollo M, de Henauw S, Lahti-Koski M, Lehtinen-Jacks S, Mullerova D, Rasmussen F, Rissanen A, Visscher TL, Lissner L. Obes Facts. 2017;10(1):61-63
Santos et al 2021	A Systematic Review of Salt Reduction Initiatives Around the World: A Midterm Evaluation of Progress Towards the 2025 Global Non-Communicable Diseases Salt Reduction Target. Santos JA, Tekle D, Rosewarne E, Flexner N, Cobb L, Al-Jawaldeh A, Kim WJ, Breda J, Whiting S, Campbell N, Neal B, Webster J, Trieu K. Adv Nutr. 2021;12(5):1768-1780.
Sares-Jäske et al 2022	Family socioeconomic status and childhood adiposity in Europe - A scoping review. Sares-Jäske L, Grönqvist A, Mäki P, Tolonen H, Laatikainen T. Prev Med. 2022;160:107095.
Sarink et al 2016	The impact of menu energy labelling across socioeconomic groups: A systematic review. Sarink D, Peeters A, Freak-Poli R, Beauchamp A, Woods J, Ball K, Backholer K. Appetite. 2016;99:59-75.
Serry et al 2020	Évolution des messages sanitaires devant accompagner les publicités de certains aliments et boissons et préconisations concernant l'encadrement du marketing des produits gras, sucrés, salés en direction des enfants. Réponse à la saisine de la DGS du 2 octobre 2018. Serry A-J, Escalon H, Friant-Perrot M. Paris: Santé Publique France, 2020.
Shangguan et al 2021	Health Impact and Cost-Effectiveness of Achieving the National Salt and Sugar Reduction Initiative Voluntary Sugar Reduction Targets in the United States: A Microsimulation Study. Shangguan S, Mozaffarian D, Sy S, Lee Y, Liu J, Wilde PE, Sharkey AL, Dowling EA, Marklund M, Abrahams-Gessel S, Gaziano TA, Micha R. Circulation. 2021;144(17):1362-1376.
Spence, Delve et al 2014	Did school food and nutrient-based standards in England impact on 11-12Y olds nutrient intake at lunchtime and in total diet? Repeat cross-sectional study. Spence S, Delve J, Stamp E, Matthews JN, White M, Adamson AJ. PLoS One. 2014;9(11):e112648.

Text reference	Full references
Spence, Matthews et al 2014	A repeat cross-sectional study examining the equitable impact of nutritional standards for school lunches in England in 2008 on the diets of 4-7y olds across the socio-economic spectrum. Spence S, Matthews JN, White M, Adamson AJ. Int J Behav Nutr Phys Act. 2014;11:128.
Steenhuis et al 2011	Consumer food choices: the role of price and pricing strategies. Steenhuis IH, Waterlander WE, de Mul A. Public Health Nutr. 2011;14(12):2220-6.
Storcksdieck genannt Bonsmann and Wills 2012	Nutrition labeling to prevent obesity: reviewing the evidence from Europe. Storcksdieck genannt Bonsmann S, Wills JM. Curr Obes Rep. 2012;1:134–140.
Tatlow-Golden and Garde 2020	Digital food marketing to children: Exploitation, surveillance and rights violations Tatlow-Golden M,Garde A. Global Food Security 2020;27:100423.
Tatlow-Golden et al 2014	Young children's food brand knowledge. Early development and associations with television viewing and parent's diet. Tatlow-Golden M, Hennessy E, Dean M, Hollywood L. Appetite. 2014;80:197-203.
Tedstone et al 2022	Towards a regulation of food advertising? Tedstone AE, Bell H, Brayley M, Wall R. Proc Nutr Soc. 2022;81(4):265-271.
Thomas et al 2019	Area deprivation, screen time and consumption of food and drink high in fat salt and sugar (HFSS) in young people: results from a cross-sectional study in the UK. Thomas F, Thomas C, Hooper L, Rosenberg G, Vohra J, Bauld L. BMJ Open. 2019;9(6):e027333.
Thomson et al 2018	The effects of public health policies on health inequalities in high-income countries: an umbrella review. Thomson K, Hillier-Brown F, Todd A, McNamara C, Huijts T, Bambra C. BMC Public Health. 2018;18(1):869.
UNICEF 2021	UNICEF technical note on effective regulatory approaches to protect, support and promote better diets and create healthy food environments for children. New York: UNICEF, 2021.

Text reference	Full references
US Centers for Disease Control 2022	Health Equity Considerations. Infant and Young Child Feeding in Emergencies (IYCF-E) Toolkit. US Centers for Disease Control, September 13, 2022. https://www.cdc.gov/nutrition/emergencies-infant-feeding/health-equity.html
US Government Assistant Secretary for Planning and Evaluation 2022	Conducting Intensive Equity Assessments of Existing Programs, Policies. US Government Assistant Secretary for Planning and Evaluation, September 2022. https://aspe.hhs.gov/sites/default/files/documents/dd148f52c519a5bcc4fde76b4932f53b/Intensive-Equity-Assessment.pdf
Vandevijvere et al 2019	Effect of Formulation, Labelling, and Taxation Policies on the Nutritional Quality of the Food Supply. Vandevijvere S, Vanderlee L. Curr Nutr Rep. 2019;8(3):240-249.
Velazquez et al 2017	Food and Beverage Marketing in Schools: A Review of the Evidence. Velazquez CE, Black JL, Potvin Kent M. Int J Environ Res Public Health. 2017;14(9):1054.
Vereecken et al 2006	Television viewing behaviour and associations with food habits in different countries. Vereecken CA, Todd J, Roberts C, Mulvihill C, Maes L. Public Health Nutr. 2006;9:244-250.
Wainwright 2006	The battle of Rawnmarsh. Wainwright M. London: The Guardian, 20 September 2006.
Washington State Health Care Authority 2021	Health Equity Toolkit. Washington State Health Care Authority, 2021. https://inside.hca.wa.gov/sites/default/files/health-equity-lens-toolkit.pdf
Weale 2022	Fears rising costs will force school catering firms to pull out of contracts. Weale S. London: The Guardian, 15 June 2022.
Welch et al 2017	GRADE equity guidelines 3: considering health equity in GRADE guideline development: rating the certainty of synthesized evidence. Welch VA, Akl EA, Pottie K, Ansari MT, Briel M, Christensen R, Dans A, Dans L, Eslava-Schmalbach J, Guyatt G, Hultcrantz M, Jull J, Katikireddi SV, Lang E, Matovinovic E, Meerpohl JJ, Morton RL, Mosdol A, Murad MH, Petkovic J,

Text reference	Full references
	Schünemann H, Sharaf R, Shea B, Singh JA, Solà I, Stanev R, Stein A, Thabaneii L, Tonia T, Tristan M, Vitols S, Watine J, Tugwell P. J Clin Epidemiol. 2017;90:76-83.
WHO 2014	WHO Handbook for Guideline Development – 2nd ed. Geneva: World Health Organization, 2014.
WHO 2022	Reformulation of food and beverage products for healthier diets: policy brief. Geneva: Word Health Organization, 2022. https://www.who.int/publications/i/item/9789240039919
Wills et al 2019	Socio-Economic Factors, the Food Environment and Lunchtime Food Purchasing by Young People at Secondary School. Wills W, Danesi G, Kapetanaki AB, Hamilton L. Int J Environ Res Public Health. 2019;16(9):1605.
Young et al 2003	Attitudes of Parents Toward Advertising to Children in the UK, Sweden and New Zealand. Young B, de Bruin A, Eagle L. Journal of Marketing Management, 2003;19(3-4):475-490
Zimmerman and Shimoga 2014	The effects of food advertising and cognitive load on food choices. Zimmerman FJ, Shimoga SV. BMC Public Health. 2014;14:342.

Annex 1: Details of search terms used and selection PRISMA charts

Search terms

1. Health Equity Impact Assessment

PubMed

("health equity"[MeSH Terms] OR ("health"[All Fields] AND "equity"[All Fields]) OR "health equity"[All Fields]) AND "impact"[All Fields] AND "assessment"[All Fields] AND ("nutritional status"[MeSH Terms] OR ("nutritional"[All Fields] AND "status"[All Fields]) OR "nutritional status"[All Fields] OR "nutrition"[All Fields] OR "nutritional sciences"[MeSH Terms] OR ("nutritional"[All Fields] AND "sciences"[All Fields]) OR "nutritional sciences"[All Fields])

also

("health equity"[MeSH Terms] OR ("health"[All Fields] AND "equity"[All Fields]) OR "health equity"[All Fields]) AND "impact"[All Fields] AND "assessment"[All Fields] AND ("food"[MeSH Terms] OR "food"[All Fields])

Cochrane Methods

Equity (all publications)

Google

health AND equity AND (impact assessment) AND (nutrition OR food)

(policy impact) AND socio-economic AND food AND Europe

(risk assessment) AND nutrition AND (socio-economic)

2. Search terms used to review children food marketing restrictions

PubMed

((("marketing"[MeSH Terms] OR "marketing"[All Fields]) OR ("advertising as topic"[MeSH Terms] OR ("advertising"[All Fields] AND "topic"[All Fields]) OR "advertising as topic"[All Fields] OR "advertising"[All Fields]) OR commercials[All Fields]) AND ("child"[MeSH Terms] OR "child"[All Fields]))

AND (("food"[MeSH Terms] OR "food"[All Fields]) OR ("beverages"[MeSH Terms] OR "beverages"[All Fields]))

AND (("socioeconomic factors"[MeSH Terms] OR ("socioeconomic"[All Fields] AND "factors"[All Fields]) OR "socioeconomic factors"[All Fields] OR "inequality"[All Fields]) OR disparity[All Fields] OR ("education"[Subheading] OR "education"[All Fields] OR "educational status"[MeSH Terms] OR ("educational"[All Fields] AND "status"[All Fields]) OR "educational status"[All Fields] OR "education"[All Fields] OR "education"[MeSH Terms]) OR socio-economic[All Fields])

Cochrane

(food OR beverages) AND (marketing OR advertising OR commercials)

Google

(marketing OR advertising OR commercials) AND child AND (food OR beverages) AND (cost OR cost-benefit OR resource) AND (inequality OR disparity OR education OR socio-economic)

3. Search terms used to review food formulation

PubMed

("reformulation"[All Fields]) AND (("food"[MeSH Terms] OR "food"[All Fields]) OR ("beverages"[MeSH Terms] OR "beverages"[All Fields])) AND (("socioeconomic factors"[MeSH Terms] OR ("socioeconomic"[All Fields] AND "factors"[All Fields]) OR "socioeconomic factors"[All Fields] OR "inequality"[All Fields]) OR disparity[All Fields] OR ("education"[Subheading] OR "education"[All Fields] OR "educational status"[MeSH Terms]

OR ("educational"[All Fields] AND "status"[All Fields]) OR "educational status"[All Fields] OR "education"[All Fields] OR "education"[MeSH Terms]) OR socio-economic[All Fields])

Cochrane

Reformulation AND (food OR beverage)

Google

(reformulation) AND (food OR beverage) AND (inequality OR disparity OR education OR socio-economic)

4. Search terms used to review food procurement

PubMed

(("procurement"[All Fields]) AND ((“public”[All Fields]) OR (“school”[All Fields]) OR (“elderly”[All Fields]) OR (“senior”[All Fields]))) AND (("food"[MeSH Terms] OR "food"[All Fields]) OR ("beverages"[MeSH Terms]) OR ("beverages"[All Fields])) AND (("socioeconomic factors"[MeSH Terms] OR ("socioeconomic"[All Fields] AND "factors"[All Fields]) OR "socioeconomic factors"[All Fields] OR "inequality"[All Fields]) OR disparity[All Fields] OR ("education"[Subheading] OR "education"[All Fields] OR "educational status"[MeSH Terms] OR ("educational"[All Fields] AND "status"[All Fields]) OR "educational status"[All Fields] OR "education"[All Fields] OR "education"[MeSH Terms]) OR socio-economic[All Fields])

Cochrane

(food OR beverage) AND procurement AND (public OR school)

Google

(reformulation) AND (food OR beverages) AND (inequality OR disparity OR socio-economic)

PRISMA charts

3.1. Summary PRISMA charts

Fig 3.1. PRISMA chart: Health equity policy impact criteria

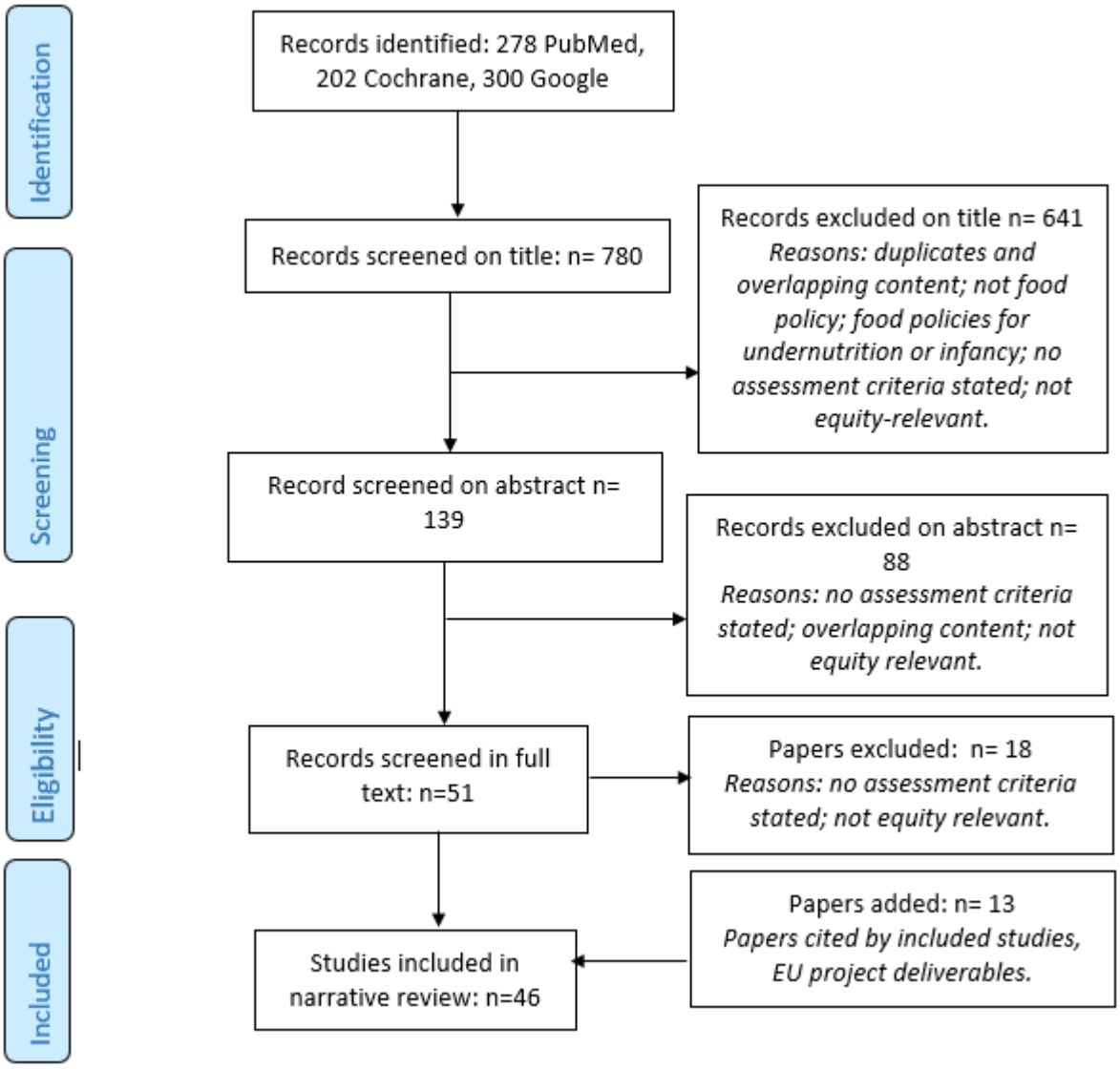


Fig 3.2. PRISMA chart: Children's exposure to food and beverage promotion

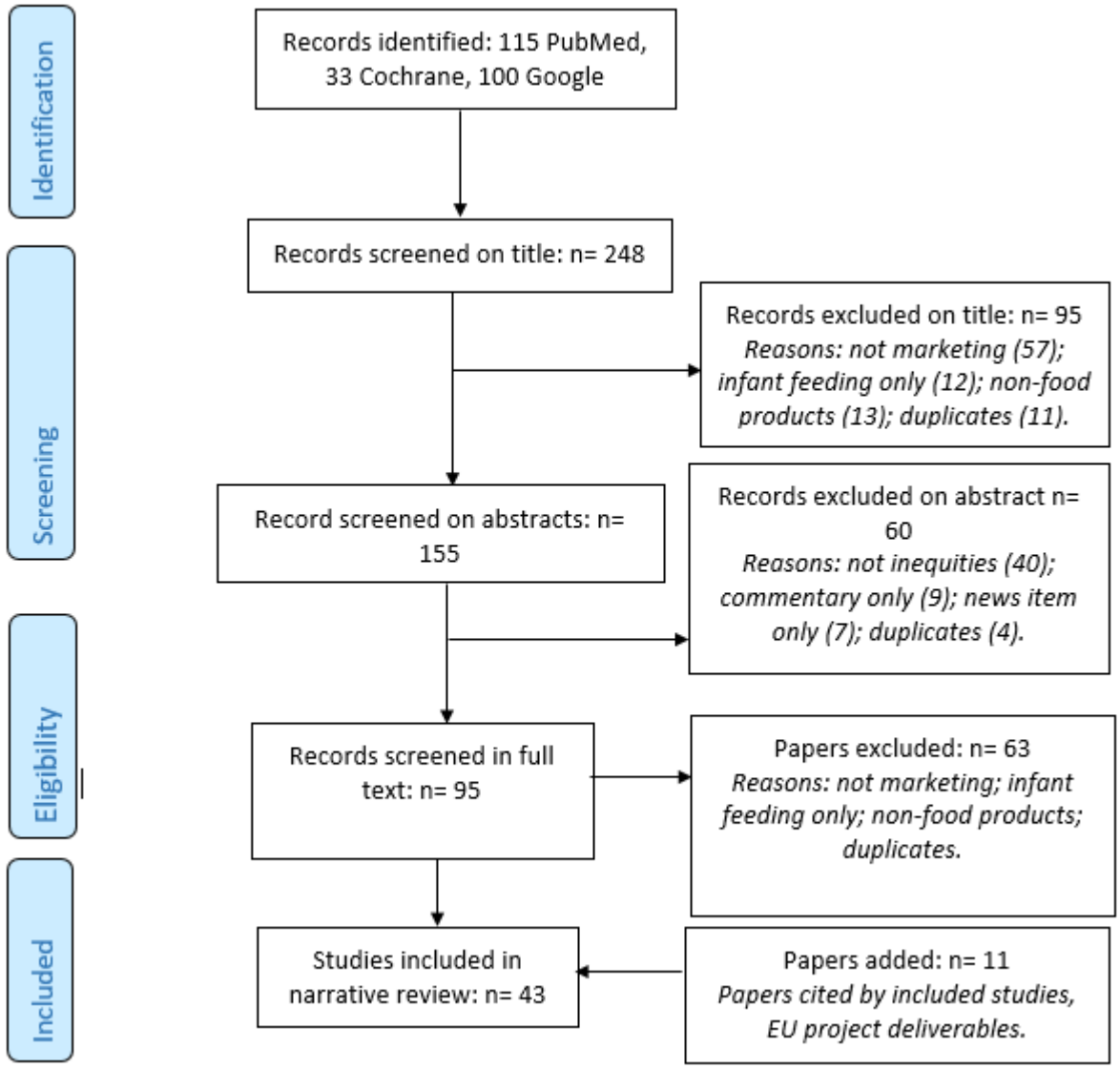


Fig 3.3. PRISMA chart: Food and beverage reformulation

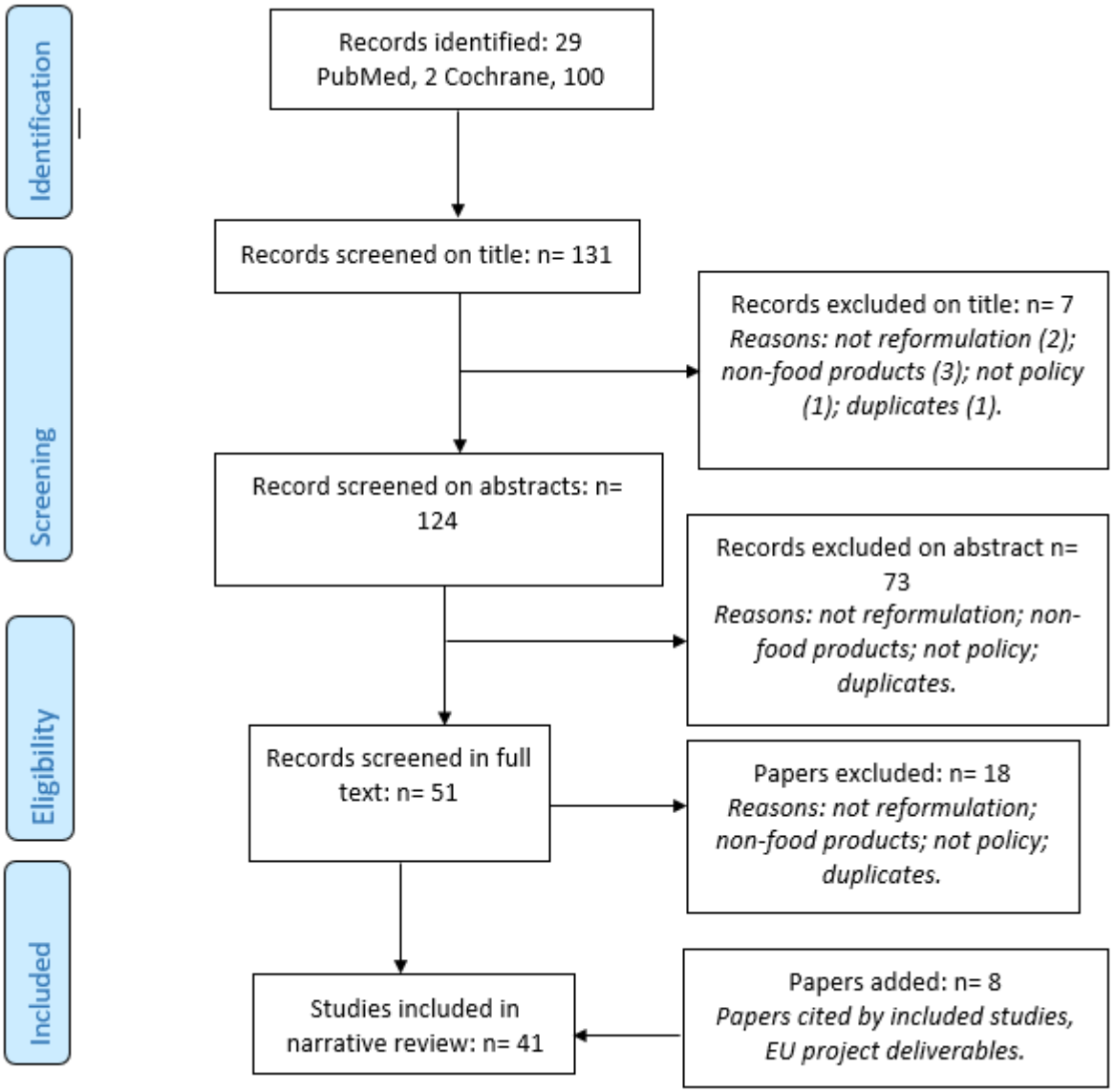
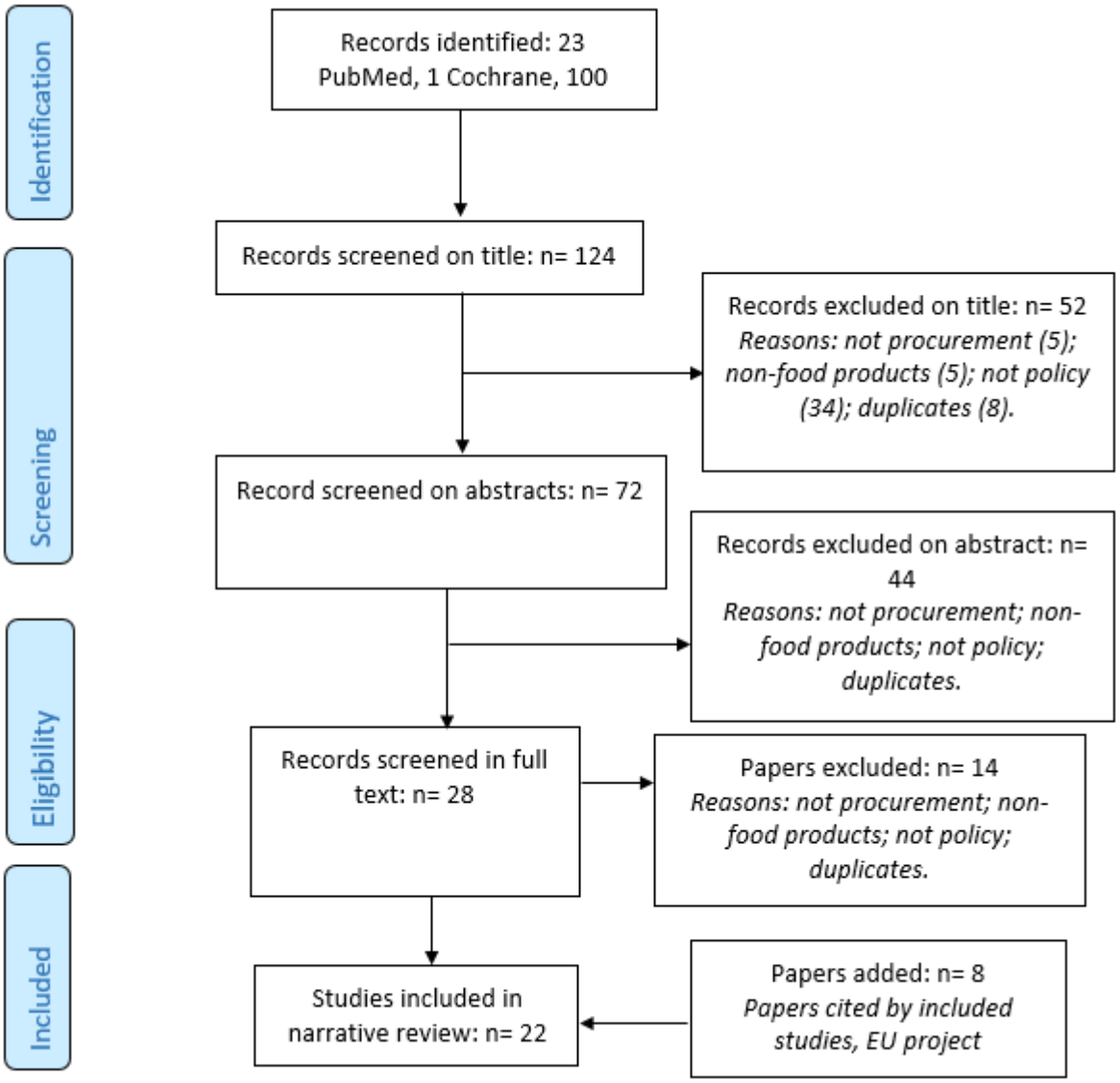


Fig 3.4. PRISMA chart: Public procurement of food and beverage



Annex 2: Papers included in review (PRISMA 'full text')

Annex 2.1: Health equity impact literature

Ahrens et al 2022	Dietary behaviour and physical activity policies in Europe: learnings from the Policy Evaluation Network (PEN). Ahrens W, Brenner H, Flechtner-Mors M, Harrington JM, Hebestreit A, Kamphuis CBM, Kelly L, Laxy M, Luszczynska A, Mazzocchi M, Murrin C, Poelman MP, Steenhuis I, Roos G, Steinacker JM, van Lenthe F, Zeeb H, Zukowska J, Lakerveld J, Woods CB. Eur J Public Health. 2022;32(Suppl 4):iv114-iv125.
Backholer and Peeters 2017	The utility of the agency-structure framework to estimate the health equity impact of universal obesity prevention policies. Backholer K, Peeters A. Obes Rev. 2017;18(1):126-128.
Backholer et al 2014	A framework for evaluating the impact of obesity prevention strategies on socioeconomic inequalities in weight. Backholer K, Beauchamp A, Ball K, Turrell G, Martin J, Woods J, Peeters A. Am J Public Health. 2014;104(10):e43-50.
Backholer et al 2021	Differential exposure to, and potential impact of, unhealthy advertising to children by socio-economic and ethnic groups: A systematic review of the evidence. Backholer K, Gupta A, Zorbas C, Bennett R, Huse O, Chung A, Isaacs A, Golds G, Kelly B, Peeters A. Obes Rev. 2021;22(3):e13144.
Baum et al 2016	Assessing the health impact of transnational corporations: its importance and a framework. Baum FE, Sanders DM, Fisher M, Anaf J, Freudenberg N, Friel S, Labonté R, London L, Monteiro C, Scott-Samuel A, Sen A. Global Health. 2016;12(1):27.
Beauchamp et al 2014	The effect of obesity prevention interventions according to socioeconomic position: a systematic review. Beauchamp A, Backholer K, Magliano D, Peeters A. Obes Rev. 2014;15(7):541-54.

Boelsen-Robinson et al 2015	A systematic review of the effectiveness of whole-of-community interventions by socioeconomic position. Boelsen-Robinson T, Peeters A, Beauchamp A, Chung A, Gearon E, Backholer K. Obes Rev. 2015;16(9):806-16.
Campos et al 2011	Nutrition labels on pre-packaged foods: a systematic review. Campos S, Doxey J, Hammond D. Public Health Nutr. 2011;14(8):1496-506.
Canadian Public Health Authority 2020	Canadian Public Health Authority. Health Equity Impact Assessment. January 2020. https://cpha.ca/policy-statement-health-equity-impact-assessment
Dewidar et al 2020	Over half of the WHO guidelines published from 2014 to 2019 explicitly considered health equity issues: a cross-sectional survey. Dewidar O, Tsang P, León-García M, Mathew C, Antequera A, Baldeh T, Akl EA, Alonso-Coello P, Petkovic J, Piggott T, Pottie K, Schünemann H, Tugwell P, Welch V J Clin Epidemiol. 2020;127:125-133.
Escaron et al 2019	RE-AIM analysis of a community-partnered policy, systems, and environment approach to increasing consumption of healthy foods in schools serving low-income populations. Escaron AL, Martinez C, Vega-Herrera C, Enger SM. Transl Behav Med. 2019;9(5):899-909.
Feteira-Santos et al 2021	Looking Ahead: Health Impact Assessment of Front-Of-Pack Nutrition Labelling Schema as a Public Health Measure. Feteira-Santos R, Alarcão V, Santos O, Virgolino A, Fernandes J, Vieira CP, João Gregório M, Nogueira P, Costa A, Graça P. Int J Environ Res Public Health. 2021;18(4):1422.
Goldblatt 2018	Scientific report on evidence based interventions to reduce socio-economic inequalities in diet and physical activity. Goldblatt P. Health Equity Pilot Project (HEPP) Evidence Review. Brussels: European Commission, 2018. https://health.ec.europa.eu/publications/scientific-report-evidence-based-interventions-reduce-socio-economic-inequalities-diet-and-physical_en
Gubbels et al 2015	The assessment of ongoing community-based interventions to prevent obesity: lessons learned. Gubbels JS, Mathisen FK, Samdal O, Lobstein T, Kohl LF, Leversen I, Lakerveld J, Kremers SP, van Assema P. BMC Public Health. 2015;15:216.

Gunter 2012	A series of questions to analyse equity in the policy Health Impact Assessment process. (Revised draft following HIA training Nov 2011). Gunter S. Annex 2 of Learning from Equity Action Health Impact Assessment (Processing and Training), Equity Action, 2012. https://health-inequalities.eu/wp-content/uploads/2021/01/Learning_from_equity_Action_Health_impact_Assessment_and_equity.pdf
Hall et al 2016	Policy Approaches to Advancing Health Equity. Hall M, Graffunder C, Metzler M. J Public Health Manag Pract. 2016;22 Suppl 1:S50-9.
IPH 2016	IPH. Health Impact Assessment Guidance: A Manual. Dublin: Institute of Public Health, 2022. https://publichealth.ie/hia/guidance.pdf
JAHEE 2020	Deliverable 9.1 Policy Framework for Action. Work Package 9: Health and Equity in All Policies – Governance. Joint Action – Health Equity Europe (JAHEE), 2020. https://jahee.iss.it/wp-content/uploads/2020/12/D9.1-WP9-PFA.pdf
Kumanyika 2017	Getting to Equity in Obesity Prevention: A New Framework. Kumanyika S. Washington DC: National Academy of Medicine Discussion Paper, January 18, 2017. https://nam.edu/getting-to-equity-in-obesity-prevention-a-new-framework/
Lakerveld et al 2012	Sustainable prevention of obesity through integrated strategies: The SPOTLIGHT project's conceptual framework and design. Lakerveld J, Brug J, Bot S, Teixeira PJ, Rutter H, Woodward E, Samdal O, Stockley L, De Bourdeaudhuij I, van Assema P, Robertson A, Lobstein T, Oppert JM, Adány R, Nijpels G; SPOTLIGHT consortium. BMC Public Health. 2012;12:793.
Lobstein 2014	Diet, Nutrition and Obesity. Task 1. Evidence, Research and Economic Analysis of Nutrition, Obesity and Health Inequalities. Lobstein T. Papers produced for the Health Inequalities Audit Process – Equity Action. Brussels: Health Equity, 2014. https://1drv.ms/b/s!AigZubAnDvQWdAkc_uOmZmStw0c?e=jCnkeK
Lobstein et al 2020	Costs, equity and acceptability of three policies to prevent obesity: A narrative review to support policy development. Lobstein T, Neveux M, Landon J. Obes Sci Pract. 2020;6(5):562-583.
Lobstein and Neveux 2012	Deliverable D4.1a A review of systematic reviews of the impact on children of three population-wide policies; Deliverable D4.1b A systematic review of the impact of three population-wide policies on socio-economic disparities in child obesity.

	Lobstein T, Neveux M. EU STOP Project. Imperial College London, 2021. https://www.stopchildobesity.eu/wp-content/uploads/2021/10/D4.1.pdf
Lobstein 2015	Inequalities and obesity: Evidence and gaps. Lobstein T. Presentation on behalf of Equity Action to the Twenty-second plenary meeting of the High Level Group on Nutrition and Physical Activity, European Commission, Brussels, February 18, 2015. https://health.ec.europa.eu/latest-updates/presentations-twenty-second-plenary-meeting-high-level-group-nutrition-and-physical-activity-18-2015-02-20_en
Lobstein 2017	The impact of interventions and policies on SES differentials in obesity and diet. Lobstein T. Health Equity Pilot Project (HEPP) Evidence Review. Brussels: European Commission, 2017. https://health.ec.europa.eu/document/download/3dc7a3ce-c584-40d5-ae48-40b458dd1e6e_en?filename=hepp_screport_nutrition_b1000days_en.pdf
Lobstein 2023	Social disparities in child obesity in Europe are getting worse. Lobstein T. Online report of the STOP Project, World Obesity Federation, 2023. https://www.worldobesity.org/news/social-disparities-in-child-obesity-a-report-from-the-stop-project
Lorenc et al 2013	What types of interventions generate inequalities? Evidence from systematic reviews. Lorenc T, Petticrew M, Welch V, Tugwell P. J Epidemiol Community Health. 2013;67(2):190-3.
Loring and Robertson 2014	Obesity and inequities. Guidance for addressing inequities in overweight and obesity. Loring B, Robertson A. Copenhagen: World Health Organization, 2014.
Magnée et al 2013	Equity-specific effects of 26 Dutch obesity-related lifestyle interventions. Magnée T, Burdorf A, Brug J, Kremers SP, Oenema A, van Assema P, Ezendam NP, van Genugten L, Hendriksen IJ, Hopman-Rock M, Jansen W, de Jong J, Kocken PL, Kroeze W, Kwak L, Lechner L, de Nooijer J, van Poppel MN, Robroek SJ, Schreurs H, van Sluijs EM, Steenhuis IJ, van Stralen MM, Tak NI, te Velde SJ, Vermeer WM, Wammes B, van Wier MF, van Lenthe FJ. Am J Prev Med. 2013;44(6):e57-66.
Mayén et al 2016	Interventions promoting healthy eating as a tool for reducing social inequalities in diet in low- and middle-income countries: a systematic review. Mayén AL, de Mestral C, Zamora G, Paccaud F, Marques-Vidal P, Bovet P, Stringhini S. Int J Equity Health. 2016;15(1):205.

McGill et al 2015	Are interventions to promote healthy eating equally effective for all? Systematic review of socioeconomic inequalities in impact. McGill R, Anwar E, Orton L, Bromley H, Lloyd-Williams F, O'Flaherty M, Taylor-Robinson D, Guzman-Castillo M, Gillespie D, Moreira P, Allen K, Hyseni L, Calder N, Petticrew M, White M, Whitehead M, Capewell S. BMC Public Health. 2015;15:457.
Msora-Kasago 2020	Understanding and Promoting Nutrition and Health Equity. Msora-Kasago C. Food and Nutrition, September 11, 2020. https://foodandnutrition.org/from-the-magazine/understanding-and-promoting-nutrition-and-health-equity/
Neter et al 2016	Dutch food bank parcels do not meet nutritional guidelines for a healthy diet. Neter JE, Dijkstra SC, Visser M, Brouwer IA. Br J Nutr. 2016;116(3):526-33.
Olstad et al 2016	Can policy ameliorate socioeconomic inequities in obesity and obesity-related behaviours? A systematic review of the impact of universal policies on adults and children. Olstad DL, Teychenne M, Minaker LM, Taber DR, Raine KD, Nykiforuk CI, Ball K. Obes Rev. 2016;17(12):1198-1217.
Oosterhoff et al 2020	Lifetime cost-effectiveness and equity impacts of the Healthy Primary School of the Future initiative. Oosterhoff M, Over EAB, van Giessen A, Hoogenveen RT, Bosma H, van Schayck OCP, Joore MA. BMC Public Health. 2020;20(1):1887.
Peeters and Backholer 2015	Reducing socioeconomic inequalities in obesity: the role of population prevention. Peeters A, Backholer K. Lancet Diabetes Endocrinol. 2015;3(11):838-40.
PHE 2020	Health Equity Assessment Tool. London: Public Health England, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/989157/HEAT_full_version-ODT.odt
Poyall et al 2014	Health equity impact assessment. Povall SL, Haigh FA, Abrahams D, Scott-Samuel A. Health Promot Int. 2014;29(4):621-33.
Robertson et al 2007	Obesity and socio-economic groups in Europe: Evidence review and implications for action. Robertson A, Lobstein T, Knai C. Prepared for the European Commission, (SANCO/2005/C4-NUTRITION-03), Brussels, 2007. http://ec.europa.eu/health/ph_determinants/life_style/nutrition/documents/ev20081028_rep_en.pdf

Sarink et al 2016	The impact of menu energy labelling across socioeconomic groups: A systematic review. Sarink D, Peeters A, Freak-Poli R, Beauchamp A, Woods J, Ball K, Backholer K. Appetite. 2016;99:59-75.
Spence, Matthews et al 2014	A repeat cross-sectional study examining the equitable impact of nutritional standards for school lunches in England in 2008 on the diets of 4-7y olds across the socio-economic spectrum. Spence S, Matthews JN, White M, Adamson AJ. Int J Behav Nutr Phys Act. 2014;11:128.
Thomson et al 2018	The effects of public health policies on health inequalities in high-income countries: an umbrella review. Thomson K, Hillier-Brown F, Todd A, McNamara C, Huijts T, Bambra C. BMC Public Health. 2018;18(1):869.
US Centers for Disease Control 2022	Health Equity Considerations. Infant and Young Child Feeding in Emergencies (IYCF-E) Toolkit. US Centers for Disease Control, September 13, 2022. https://www.cdc.gov/nutrition/emergencies-infant-feeding/health-equity.html
US Government Assistant Secretary for Planning and Evaluation 2022	Conducting Intensive Equity Assessments of Existing Programs, Policies. US Government Assistant Secretary for Planning and Evaluation, September 2022. https://aspe.hhs.gov/sites/default/files/documents/dd148f52c519a5bcc4fde76b4932f53b/Intensive-Equity-Assessment.pdf
Velazquez et al 2017	Food and Beverage Marketing in Schools: A Review of the Evidence. Velazquez CE, Black JL, Potvin Kent M. Int J Environ Res Public Health. 2017;14(9):1054.
Washington State Health Care Authority 2021	Health Equity Toolkit. Washington State Health Care Authority, 2021. https://inside.hca.wa.gov/sites/default/files/health-equity-lens-toolkit.pdf
Welch et al 2017	GRADE equity guidelines 3: considering health equity in GRADE guideline development: rating the certainty of synthesized evidence. Welch VA, Akl EA, Pottie K, Ansari MT, Briel M, Christensen R, Dans A, Dans L, Eslava-Schmalbach J, Guyatt G, Hultcrantz M, Jull J, Katikireddi SV, Lang E, Matovinovic E, Meerpohl JJ, Morton RL, Mosdol A, Murad MH, Petkovic J,

	Schünemann H, Sharaf R, Shea B, Singh JA, Solà I, Stanev R, Stein A, Thabaneii L, Tonia T, Tristan M, Vitols S, Watine J, Tugwell P. J Clin Epidemiol. 2017;90:76-83.
WHO 2014	WHO Handbook for Guideline Development – 2nd ed. Geneva: World Health Organization, 2014. (added)

Annex 2.2: Marketing literature

Adams et al 2012	Socio-economic differences in exposure to television food advertisements in the UK: a cross-sectional study of advertisements broadcast in one television region. Adams J, Tyrrell R, Adamson AJ, White M. Public Health Nutr. 2012;15(3):487-94.
Adams, Ganti et al 2011	Socio-economic differences in outdoor food advertising in a city in Northern England. Adams J, Ganiti E, White M. Public Health Nutr. 2011;14(6):945-50.
Adams, Simpson et al 2011	Variations in food and drink advertising in UK monthly women's magazines according to season, magazine type and socio-economic profile of readers: a descriptive study of publications over 12 months. BMC Public Health. Adams J, Simpson E, White M. 2011;11:368.
Bachkholer et al 2021	Differential exposure to, and potential impact of, unhealthy advertising to children by socio-economic and ethnic groups: A systematic review of the evidence. Backholer K, Gupta A, Zorbas C, Bennett R, Huse O, Chung A, Isaacs A, Golds G, Kelly B, Peeters A. Obes Rev. 2021;22(3):e13144.
Boyland et al 2022	Association of Food and Nonalcoholic Beverage Marketing With Children and Adolescents' Eating Behaviors and Health: A Systematic Review and Meta-analysis. Boyland E, McGale L, Maden M, Hounsome J, Boland A, Angus K, Jones A. JAMA Pediatr. 2022;176(7):e221037.

Brown et al 2018	The Potential Cost-Effectiveness and Equity Impacts of Restricting Television Advertising of Unhealthy Food and Beverages to Australian Children. Brown V, Ananthapavan J, Veerman L, Sacks G, Lal A, Peeters A, Backholer K, Moodie M. Nutrients. 2018;10(5):622.
Buijzen et al 2008	Associations between children's television advertising exposure and their food consumption patterns: a household diary-survey study. Buijzen M, Schuurman J, Bomhof E. Appetite. 2008;50(2-3):231-9.
Chambers et al 2015	Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: A systematic review of the evidence from statutory and self-regulatory actions and educational measures. Chambers SA, Freeman R, Anderson AS, MacGillivray S. Prev Med. 2015;75:32-43.
Coleman et al 2022	A rapid review of the evidence for children's TV and online advertisement restrictions to fight obesity. Coleman PC, Hanson P, van Rens T, Oyebode O. Prev Med Rep. 2022;26:101717.
CSPI 2021	Food Marketing to Kids: Targeted Marketing. Washington DC: Center for Science in the Public Interest, 2021. https://www.cspinet.org/advocacy/nutrition/food-marketing-kids
DDHSC 2021	Department for Health and Social Care and Department for Digital Culture Media and Sport. Equality assessment: introducing further advertising restrictions on TV and online for products high in fat, salt and sugar. Consultation outcome. London: UK Government, 24 June 2021. https://www.gov.uk/government/consultations/further-advertising-restrictions-for-products-high-in-fat-salt-and-sugar/outcome/equality-assessment-introducing-further-advertising-restrictions-on-tv-and-online-for-products-high-in-fat-salt-and-sugar#summary-of-the-effects-of-the-policy-on-people-with-protected-characteristics
Dens et al 2007	Parental attitudes towards advertising to children and restrictive mediation of children's television viewing in Belgium. Dens N, De Pelsmacker P, Eagle L. Young Consumers, 2007;8(1):7-18.
Galbraith-Emami and Lobstein 2013	The impact of initiatives to limit the advertising of food and beverage products to children: a systematic review. Galbraith-Emami S, Lobstein T. Obes Rev, 2013;14(12):960-74.

Griffith et al 2019	The potential impacts of banning television advertising of HFSS food and drink before the watershed. Griffith R, O'Connell M, Smith K, Stroud R. London: Institute for Fiscal Studies: 2019. https://ifs.org.uk/publications/potential-impacts-banning-television-advertising-hfss-food-and-drink-watershed
Harris et al 2022	Targeted food and beverage advertising to Black and Hispanic consumers: 2022 update. Harris JL, Fleming-Milici F, Mancini S, Kumanyika S, Ramirez AG. Rudd Report. Hartford: UConn Rudd Center for Food Policy and Health, University of Connecticut, 2022. https://uconnruddcenter.org/targetedmarketing2022/
Kelly et al 2021	Australian Children's Exposure to, and Engagement With, Web-Based Marketing of Food and Drink Brands: Cross-sectional Observational Study. Kelly B, Bosward R, Freeman B. J Med Internet Res. 2021;23(7):e28144.
Kent et al 2022	Evidence synthesis – Benchmarking unhealthy food marketing to children and adolescents in Canada: a scoping review. Kent MP, Hatoum F, Wu D, Remedios L, Bagnato M. Health Promotion and Chronic Disease Prevention in Canada,, 2022;42(8):307-318.
Klepp et al 2007	Television viewing and exposure to food-related commercials among European school children, associations with fruit and vegetable intake: a cross sectional study. Klepp K-I, Wind M, de Bourdeaudhuij I, Rodrigo CP, Due P, Bjelland M, Brug J. Int J Behav Nutr Phys Act. 2007;4:46.
Landwehr and Hartmann 2020	Industry Self-Regulation of Food Advertisement to Children: Compliance versus Effectiveness of the EU Pledge. Landwehr, SC, and Hartmann, M. Food Policy 2020;91:101833.
Lobstein 2017	The impact of interventions and policies on SES differentials in obesity and diet. Lobstein T. Health Equity Pilot Project (HEPP) Evidence Review. Brussels: European Commission, 2017. https://health.ec.europa.eu/document/download/3dc7a3ce-c584-40d5-ae48-40b458dd1e6e_en?filename=hepp_screport_nutrition_b1000days_en.pdf
Lobstein et al 2020	Costs, equity and acceptability of three policies to prevent obesity: A narrative review to support policy development. Lobstein T, Neveux M, Landon J. Obes Sci Pract. 2020;6(5):562-583.

Mytton et al 2020	The potential health impact of restricting less-healthy food and beverage advertising on UK television between 05.30 and 21.00 hours: A modelling study. Mytton OT, Boyland E, Adams J, Collins B, O'Connell M, Russell SJ, Smith K, Stroud R, Viner RM, Cobiac LJ. PLoS Med. 2020;17(10):e1003212.
Najkaruma et al 2015	Price promotions on healthier compared with less healthy foods: a hierarchical regression analysis of the impact on sales and social patterning of responses to promotions in Great Britain. Nakamura R, Suhrcke M, Jebb SA, Pechey R, Almiron-Roig E, Marteau TM. Am J Clin Nutr. 2015;101:808-16. (Erratum in Am J Clin Nutr. 2015;102:980.)
Ofcom 2008	Changes in the nature and balance of television food advertising to children A review of HFSS advertising restrictions. London: Office of Communications (Ofcom), 2008.
Ofcom 2022	Children and parents: media use and attitudes report 2022. Annex 2: Children who may be classed as vulnerable. London: Office of Communications (Ofcom), 2022. https://www.ofcom.org.uk/__data/assets/pdf_file/0024/234528/annex-2-childrens-media-use-and-attitudes-report-2022.pdf
Olsen et al 2021	Exposure to unhealthy product advertising: Spatial proximity analysis to schools and socio-economic inequalities in daily exposure measured using Scottish Children's individual-level GPS data. Olsen JR, Patterson C, Caryl FM, Robertson T, Mooney SJ, Rundle AG, Mitchell R, Hilton S. Health Place. 2021;68:102535
Palmer et al 2021	A deep learning approach to identify unhealthy advertisements in street view images. Palmer G, Green M, Boyland E, Vasconcelos YSR, Savani R, Singleton A. Sci Rep. 2021;11(1):4884.
Parke and Tatlow-Golden 2019	Children's exposure to digital ads for unhealthy items is underestimated: Examining the Kantar Consulting HFSS Digital Advertising Analysis in DCMS/DHSC Impact Assessment. Parke D, Tatlow-Golden M. London: Obesity Health Alliance, 2019. https://obesityhealthalliance.org.uk/wp-content/uploads/2019/06/Children%E2%80%99s-exposure-to-HFSS-ads-online-Parker-Tatlow-Golden.pdf
Powell et al 2014	Racial/ethnic and income disparities in child and adolescent exposure to food and beverage television ads across the U.S. media markets. Powell LM, Wada R, Kumanyika SK. Health Place. 2014;29:124-31.

Russell et al 2019	The effect of screen advertising on children's dietary intake: A systematic review and meta-analysis. Russell SJ, Croker H, Viner RM. Obes Rev. 2019;20(4):554-568.
Tatlow-Golden and Garde 2020	Digital food marketing to children: Exploitation, surveillance and rights violations Tatlow-Golden M,Garde A. Global Food Security 2020;27:100423.
Tatlow-Golden et al 2014	Young children's food brand knowledge. Early development and associations with television viewing and parent's diet. Tatlow-Golden M, Hennessy E, Dean M, Hollywood L. Appetite. 2014;80:197-203.
Tedstone et al 2022	Towards a regulation of food advertising? Tedstone AE, Bell H, Brayley M, Wall R. Proc Nutr Soc. 2022;81(4):265-271.
Thomas et al 2019	Area deprivation, screen time and consumption of food and drink high in fat salt and sugar (HFSS) in young people: results from a cross-sectional study in the UK. Thomas F, Thomas C, Hooper L, Rosenberg G, Vohra J, Bauld L. BMJ Open. 2019;9(6):e027333.
Vereecken et al 2006	Television viewing behaviour and associations with food habits in different countries. Vereecken CA, Todd J, Roberts C, Mulvihill C, Maes L. Public Health Nutr. 2006;9:244-250.
Young et al 2003	Attitudes of Parents Toward Advertising to Children in the UK, Sweden and New Zealand. Young B, de Bruin A, Eagle L. Journal of Marketing Management, 2003;19(3-4):475-490
Zimmerman and Shimoga 2014	The effects of food advertising and cognitive load on food choices. Zimmerman FJ, Shimoga SV. BMC Public Health. 2014;14:342.

Annex 2.3 Reformulation literature

Al-Jawaldeh et al 2022	Sugar Reduction Initiatives in the Eastern Mediterranean Region: A Systematic Review. Al-Jawaldeh A, Taktouk M, Naalbandian S, Aguenaou H, Al Hamad N, Almamary S, Al-Tamimi HA, Alyafei SA, Barham R, Hoteit M, Hussain M, Massad H, Nasreddine L. Nutrients. 2022;15(1):55.
Arumugam 2011	Campbell Soup increases sodium as new studies vindicate salt. Arumugam N. Forbes, 18th July 2011. https://www.forbes.com/sites/nadiaarumugam/2011/07/18/campbell-soup-increases-sodium-as-new-studies-vindicate-salt/
Barberio et al 2017	Population-level interventions in government jurisdictions for dietary sodium reduction: a Cochrane Review. Barberio AM, Sumar N, Trieu K, Lorenzetti DL, Tarasuk V, Webster J, Campbell NRC, McLaren L. Int J Epidemiol. 2017;46(5):1551-1405.
Boylan et al 2011	Socio-economic circumstances and food habits in Eastern, Central and Western European populations. Boylan S, Lallukka T, Lahelma E, Pikhart H, Malyutina S, Pajak A, Kubinova R, Bragina O, Stepaniak U, Gillis-Januszewska A, Simonova G, Peasey A, Bobak M. Public Health Nutr. 2011;14(4):678-87.
Bucher Della Torre et al 2022	Impact of Measures Aiming to Reduce Sugars Intake in the General Population and Their Implementation in Europe: A Scoping Review. Bucher Della Torre S, Moullet C, Jotterand Chaparro C. Int J Public Health. 2022;66:1604108.
Department of Health for Ireland. 2021	Ministers Donnelly and Feighan announce significant plans to reduce levels of salt, sugar, saturated fats and calories in processed foods. Press Release. Dublin: Department of Health, 2021.
European Commission 2015	Report from the Commission to the European Parliament and the Council regarding trans fats in foods and in the overall diet of the Union population COM(2015) 619 final. Brussels: European Commission, 2015.

European Commission 2017	Food product reformulation by a supermarket chain (Albert Heijn) in the Netherlands. Brussels: Health Equity Pilot Project (HEPP). Brussels: European Commission, 2017. https://health.ec.europa.eu/publications/food-product-reformulation-supermarket-chain-albert-heijn-netherlands_en
European Commission 2018	The impact of interventions and policies on SES differentials in obesity and diet - Nutrition and diet beyond early years. Directorate-General for Health and Food Safety. Brussels: European Commission, 2018. https://health.ec.europa.eu/document/download/3dc7a3ce-c584-40d5-ae48-40b458dd1e6e_en?filename=hepp_screport_nutrition_b1000days_en.pdf
Federici et al 2019	The impact of food reformulation on nutrient intakes and health, a systematic review of modelling studies. Federici C, Detzel P, Petracca F, Dainelli L, Fattore G. BMC Nutr. 2019;5:2.
Food Standards Agency 2018	Northern Ireland consumer perceptions of reformulation of food. London: Food Standards Agency, 2018. https://www.food.gov.uk/sites/default/files/media/document/ni-consumer-perceptions-of-food-reformulation.pdf
Gillespie et al 2015	The Health Equity and Effectiveness of Policy Options to Reduce Dietary Salt Intake in England: Policy Forecast. Gillespie DO, Allen K, Guzman-Castillo M, Bandosz P, Moreira P, McGill R, Anwar E, Lloyd-Williams F, Bromley H, Diggle PJ, Capewell S, O'Flaherty M. PLoS One, 2015;10(7):e0127927.
Greiger et al 2016	Discrete strategies to reduce intake of discretionary food choices: a scoping review. Grieger JA, Wycherley TP, Johnson BJ, Golley RK. Int J Behav Nutr Phys Act. 2016;13:57.
Gressier et al 2020	Success of reformulation and health education in reducing sodium intakes across socioeconomic groups. M Gressier, G Frost, F Sassi. European Journal of Public Health 2020;30 Supp 5.
Greisser, Sassi et al 2021	Contribution of reformulation, product renewal, and changes in consumer behavior to the reduction of salt intakes in the UK population between 2008/2009 and 2016/2017. Gressier M, Sassi F, Frost G. Am J Clin Nutr. 2021;114(3):1092-1099.

Gressier, Swinburn et al 2021	What is the impact of food reformulation on individuals' behaviour, nutrient intakes and health status? A systematic review of empirical evidence. Gressier M, Swinburn B, Frost G, Segal AB, Sassi F. Obes Rev. 2021;22(2):e13139.
Griffith et al 2014	Product reformulation effective in reducing dietary salt intake. Griffith R, O'Connell M, Smith K. London: Institute for Fiscal Studies, 2014. https://ifs.org.uk/articles/product-reformulation-effective-reducing-dietary-salt-intake
He et al 2014	Salt reduction in the United Kingdom: a successful experiment in public health. He FJ, Brinsden HC, MacGregor GA. J Hum Hypertens. 2014;28(6):345-52.
Hutchinson et al 2018	Comparison of high and low trans-fatty acid consumers: analyses of UK National Diet and Nutrition Surveys before and after product reformulation. Hutchinson J, Rippin HL, Jewell J, Breda JJ, Cade JE. Public Health Nutr. 2018;21(3):465-479.
Hyesini, Elliot-Green et al 2017	Systematic review of dietary salt reduction policies: Evidence for an effectiveness hierarchy? Hyseni L, Elliot-Green A, Lloyd-Williams F, Kypridemos C, O'Flaherty M, McGill R, Orton L, Bromley H, Cappuccio FP, Capewell S. PLoS One. 2017;12(5):e0177535.
Hyseni, Atkinson et al 2017	The effects of policy actions to improve population dietary patterns and prevent diet-related non-communicable diseases: scoping review. Hyseni L, Atkinson M, Bromley H, Orton L, Lloyd-Williams F, McGill R, Capewell S. Eur J Clin Nutr. 2017;71(6):694-711.
IEA 2020	IEA. Food reformulation by stealth designed to please Public Health England, not consumers, says new IEA report. London: Institute for Economic Affairs, 16 Aug 2019. https://iea.org.uk/media/food-reformulation-by-stealth-designed-to-please-public-health-england-not-consumers-says-new-iea-report/
Ji and Cappuccio 2014	Socioeconomic inequality in salt intake in Britain 10 years after a national salt reduction programme. Ji C, Cappuccio FP. BMJ Open. 2014; 4: e005683

Lake 2021	Cited in 'Historic reforms needed to build a better food system to improve national health'. Lake A. Fuse, 15th July 2021. Newcastle: Centre for Translational Research in Public Health, 2021. http://www.fuse.ac.uk/news/historicreformsneededtobuildabetterfoodsystemtoimprovenationalhealth.html
Lehmann et al 2021	Nutrient profiling for product reformulation: public health impact and benefits for the consumer. Lehmann U, Charles VR, Vlassopoulos A, Masset G, Spieldenner J. Proc Nutr Soc. 2017;76(3):255-264.
Løvhaug et al 2022	The potential of food environment policies to reduce socioeconomic inequalities in diets and to improve healthy diets among lower socioeconomic groups: an umbrella review. Løvhaug AL, Granheim SI, Djojosoeparto SK, Harrington JM, Kamphuis CBM, Poelman MP, Roos G, Sawyer A, Stronks K, Torheim LE, Twohig C, Vandevijvere S, van Lenthe FJ, Terragni L. BMC Public Health. 2022;22(1):433.
Marklund et al 2020	Estimated health benefits, costs, and cost-effectiveness of eliminating industrial trans-fatty acids in Australia: A modelling study. Marklund M, Zheng M, Veerman JL, Wu JHY. PLoS Med. 2020;17(11):e1003407.
McLaren et al 2016	Population-level interventions in government jurisdictions for dietary sodium reduction. McLaren L, Sumar N, Barberio AM, Trieu K, Lorenzetti DL, Tarasuk V, Webster J, Campbell NRC. Cochrane Database of Systematic Reviews 2016;9:CD010166.
Ni Mhurchu et al 2013	Food prices and consumer demand: differences across income levels and ethnic groups. Ni Mhurchu C, Eyles H, Schilling C, Yang Q, Kaye-Blake W, Genç M, Blakely T. PLoS One. 2013;8(10):e75934.
OECD 2019	The Heavy Burden of Obesity: The Economics of Prevention. Paris: OECD, 2019. https://doi.org/10.1787/67450d67-en
OHID 2022b	Sugar, salt and calorie reduction and reformulation. London: Office for Health Improvement and Disparities (OHID), 2022. https://www.gov.uk/government/collections/sugar-reduction
OHID 2022c	Sugar reduction – industry progress 2015 to 2020 Including the final report for foods included in the programme and the latest data for drinks included in the Soft Drinks Industry Levy and juices and milk based drinks. London: Office for Health Improvement and Disparities (OHID), 2022.

	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1121444/Sugar-reduction-and-reformulation-progress-report-2015-to-2020.pdf
PHE 2018	Calorie reduction: The scope and ambition for action. London: Public Health England, 2018.
PHE 2019	PHE. Reduction and reformulation programme: Spring 2019 update. London: Public Health England, 2019. https://www.gov.uk/government/publications/reduction-and-reformulation-programme-spring-2019-update/reduction-and-reformulation-programme-spring-2019-update
Rippin et al 2018	An exploration of socio-economic and food characteristics of high trans fatty acid consumers in the Dutch and UK national surveys after voluntary product reformulation. Rippin HL, Hutchinson J, Ocke M, Jewell J, Breda JJ, Cade JE. Food Nutr Res. 2017;61(1):1412793.
Rosewarne et al 2022	A Global Review of National Strategies to Reduce Sodium Concentrations in Packaged Foods. Rosewarne E, Santos JA, Trieu K, Tekle D, Mhurchu CN, Jones A, Ide N, Yamamoto R, Nishida C, Webster J. Adv Nutr. 2022;13(5):1820-1833.
Santos et al 2021	A Systematic Review of Salt Reduction Initiatives Around the World: A Midterm Evaluation of Progress Towards the 2025 Global Non-Communicable Diseases Salt Reduction Target. Santos JA, Tekle D, Rosewarne E, Flexner N, Cobb L, Al-Jawaldeh A, Kim WJ, Breda J, Whiting S, Campbell N, Neal B, Webster J, Trieu K. Adv Nutr. 2021;12(5):1768-1780.
Shangguan et al 2021	Health Impact and Cost-Effectiveness of Achieving the National Salt and Sugar Reduction Initiative Voluntary Sugar Reduction Targets in the United States: A Microsimulation Study. Shangguan S, Mozaffarian D, Sy S, Lee Y, Liu J, Wilde PE, Sharkey AL, Dowling EA, Marklund M, Abrahams-Gessel S, Gaziano TA, Micha R. Circulation. 2021;144(17):1362-1376.
Steenhuis et al 2011	Consumer food choices: the role of price and pricing strategies. Steenhuis IH, Waterlander WE, de Mul A. Public Health Nutr. 2011;14(12):2220-6.

UNICEF 2021	UNICEF technical note on effective regulatory approaches to protect, support and promote better diets and create healthy food environments for children. New York: UNICEF, 2021.
Vandevijvere et al 2019	Effect of Formulation, Labelling, and Taxation Policies on the Nutritional Quality of the Food Supply. Vandevijvere S, Vanderlee L. Curr Nutr Rep. 2019;8(3):240-249.
WHO 2022	Reformulation of food and beverage products for healthier diets: policy brief. Geneva: Word Health Organization, 2022. https://www.who.int/publications/i/item/9789240039919

Annex 2.4 Procurement literature

	Procurement texts refs
Barberio et al 2017	Population-level interventions in government jurisdictions for dietary sodium reduction: a Cochrane Review. Barberio AM, Sumar N, Trieu K, Lorenzetti DL, Tarasuk V, Webster J, Campbell NRC, McLaren L. Int J Epidemiol. 2017;46(5):1551-1405.
Downs et al 2012	From paper to practice: barriers to adopting nutrition guidelines in schools. Downs SM, Farmer A, Quintanilha M, Berry TR, Mager DR, Willows ND, McCargar LJ. J Nutr Educ Behav. 2012;44(2):114-22.
Dubuisson et al 2011	Socio-economic and demographic variations in school lunch participation of French children aged 3-17 years. Dubuisson C, Lioret S, Dufour A, Calamassi-Tran G, Volatier JL, Lafay L, Turck D. Public Health Nutr. 2011;14(2):227-38.
EPHA 2019	Discussion paper: Public procurement for sustainable food environments. Brussels: European Public Health Alliance, 2019. https://epha.org/public-procurement-for-sustainable-food-environments/

European Commission 2022	School scheme by country. Brussels: European Commission, DG Agriculture and Rural Development, 2023. https://agriculture.ec.europa.eu/common-agricultural-policy/market-measures/school-fruit-vegetables-and-milk-scheme/country_en
European Commission 2023	Evaluation support study of the EU school fruit, vegetables and milk scheme. Executive summary. Brussels: European Commission, 2022. https://op.europa.eu/en/publication-detail/-/publication/85551627-6a2a-11ed-b14f-01aa75ed71a1
Hampshire County Council undated	Spend less on your weekly shop with a free school lunch. Hampshire County Council Catering Services (HC3S), undated. https://www.hants.gov.uk/educationandlearning/hc3s/education-catering/primary
ICF 2022	EU REformulation MOnitoring (EUREMO) Feasibility study for a monitoring system on reformulation initiatives for salt, sugars and fat: Final Report. ICF sa. Brussels: European Commision – European Health and Digital Executive Agency (HaDEA), 2022.
Ligaya 2012	Food Fight: High School Students Lobby to Bring Back Pizza, Coffee and Chocolate. Ligaya, A. Toronto: National Post, 8th May 2012. https://nationalpost.newspapers.com/image/514513984/?terms=Ligaya%20AND%20pizza
Madre and Guala 2022	EU School food procurement schemes. Madre Y, Guala G. Farm Europe website, 29/09/2022. https://www.farm-europe.eu/news/eu-school-food-procurement-schemes/
New Zealand Ministry of Education 2023	Ka Ora, Ka Ako / Healthy School Lunches Programme. Wellington: Te Tāhuhu o te Mātauranga / The Ministry of Education, 2023. https://www.education.govt.nz/our-work/overall-strategies-and-policies/wellbeing-in-education/free-and-healthy-school-lunches/
Niebylski et al 2014	Healthy food procurement policies and their impact. Niebylski ML, Lu T, Campbell NR, Arcand J, Schermel A, Hua D, Yeates KE, Tobe SW, Twohig PA, L'Abbé MR, Liu PP. Int J Environ Res Public Health. 2014;11(3):2608-27.
Novaković et al 2014	Socio-economic determinants of micronutrient intake and status in Europe: a systematic review. Novaković R, Cavelaars A, Geelen A, Nikolić M, Altaba II, Viñas BR, Ngo J, Golsorkhi M, Medina MW, Brzozowska A, Szczecinska

	A, de Cock D, Vansant G, Renkema M, Majem LS, Moreno LA, Glibetić M, Gurinović M, van't Veer P, de Groot LC. Public Health Nutr. 2014;17(5):1031-45.
O'Connell et al 2022	School meals as a resource for low-income families in three European countries: a comparative case approach. O'Connell R, Brannen J, Ramos V, Skuland S, Truninger M. European Societies, 2022;24:(3):251-282.
Partridge et al 2022	School meals will shrink without help to tackle rising costs, warns food boss. Partridge J, Butler P, Kollewe J. London: The Guardian, 17 May 2022.
Ransley et al 2007	Does the school fruit and vegetable scheme improve children's diet? A non-randomised controlled trial. Ransley JK, Greenwood DC, Cade JE, Blenkinsop S, Schagen I, Teeman D, Scott E, White G, Schagen S. J Epidemiol Community Health. 2007;61(8):699-703.
Rodriguez 2020	School Nutrition, Food Procurement, & Equitable Community Development. R Rodriguez. Oakland CA: The Praxis Project, 2020. https://www.thepraxisproject.org/resource/2020/school-nutrition-procurement-and-equitable-comm-dev
Spence, Delve et al 2014	Did school food and nutrient-based standards in England impact on 11-12Y olds nutrient intake at lunchtime and in total diet? Repeat cross-sectional study. Spence S, Delve J, Stamp E, Matthews JN, White M, Adamson AJ. PLoS One. 2014;9(11):e112648.
Spence, Matthews et al 2014	A repeat cross-sectional study examining the equitable impact of nutritional standards for school lunches in England in 2008 on the diets of 4-7y olds across the socio-economic spectrum. Spence S, Matthews JN, White M, Adamson AJ. Int J Behav Nutr Phys Act. 2014;11:128.
Wainwright 2006	The battle of Rawnmarsh. Wainwright M. London: The Guardian, 20 September 2006.
Weale 2022	Fears rising costs will force school catering firms to pull out of contracts. Weale S. London: The Guardian, 15 June 2022.

Wills et al 2019	Socio-Economic Factors, the Food Environment and Lunchtime Food Purchasing by Young People at Secondary School. Wills W, Danesi G, Kapetanaki AB, Hamilton L. Int J Environ Res Public Health. 2019;16(9):1605.

Annex 3: Tools for undertaking a systematic review, or a review of systematic reviews.

Contents

1. Conducting a systematic review

1.1. The PRISMA check list

1.2. The PRISMA diagram

1.3. GRADE assessments

2. Conducting a review of systematic reviews

2.1. AMSTAR-2 assessments

1. Conducting a systematic review of studies

1.1. The PRIMSA checklist

PRISMA = preferred reporting items for systematic reviews and meta-analyses

Section and Topic		Checklist item
1. TITLE		
Title		Identify the report as a systematic review.
2. ABSTRACT		
Objectives		*Provide an explicit statement of the main objective(s) or question(s) the review addresses.*
2. 1. METHODS		
Eligibility criteria		*Specify the inclusion and exclusion criteria for the review.*
Information sources		*Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.*
Risk of bias		*Specify the methods used to assess risk of bias in the included studies.*
Synthesis of results		*Specify the methods used to present and synthesise results.*
2.2. RESULTS		
Included studies		*Give the total number of included studies and participants and summarise relevant characteristics of studies.*
Synthesis of results		*Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If*

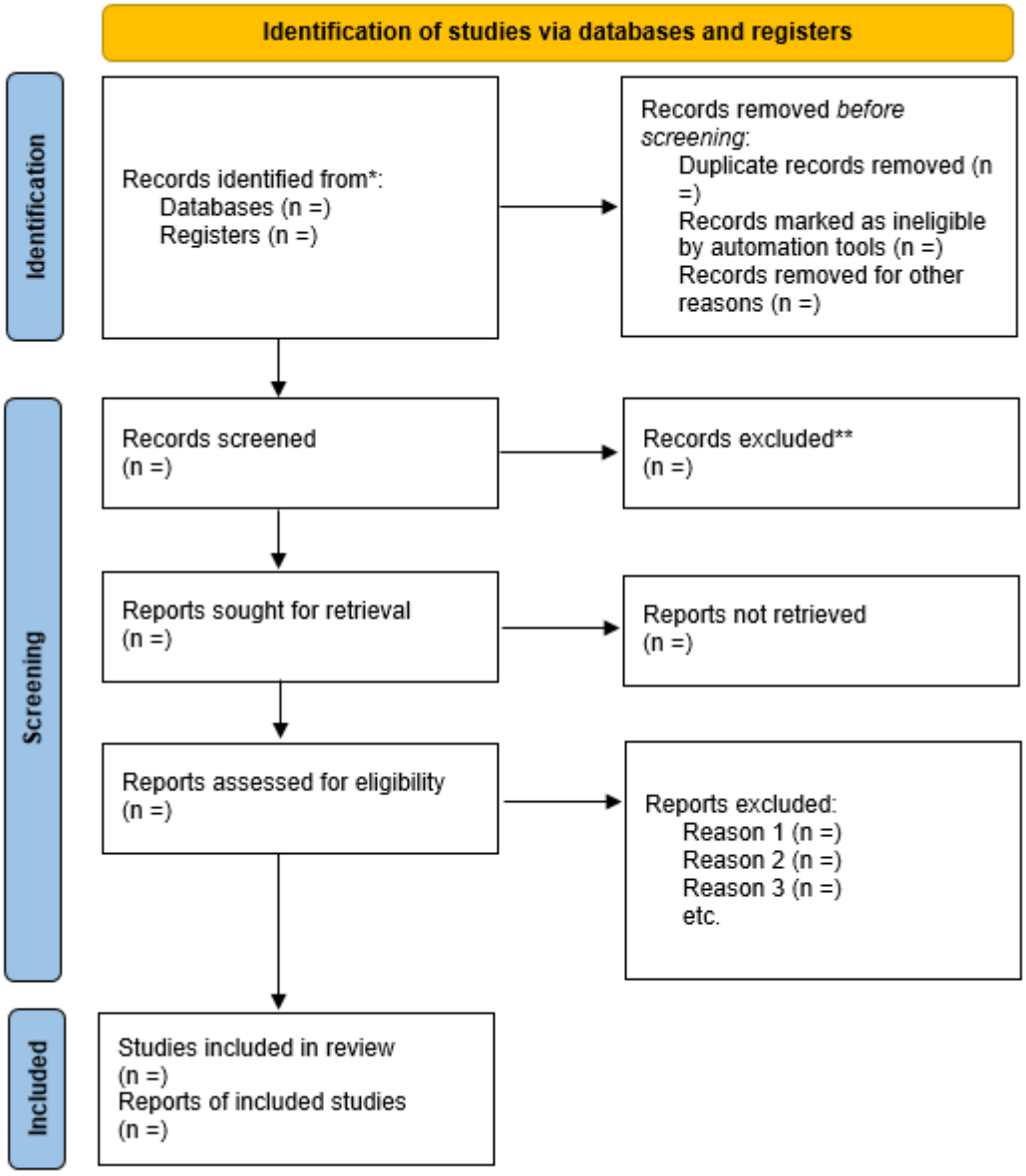
Section and Topic		Checklist item
		comparing groups, indicate the direction of the effect (i.e. which group is favoured).
2.3. DISCUSSION		
Limitations of evidence		*Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).*
Interpretation		*Provide a general interpretation of the results and important implications.*
3. INTRODUCTION		
Rationale		Describe the rationale for the review in the context of existing knowledge.
Objectives		Provide an explicit statement of the objective(s) or question(s) the review addresses.
4. METHODS		
Eligibility criteria		Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.
Information sources		Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.
Search strategy		Present the full search strategies for all databases, registers and websites, including any filters and limits used.
Selection process		Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.
Data collection process		Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.
Data items		List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.
		List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.
Study risk of bias assessment		Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.
Effect measures		Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.
Synthesis methods		Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).
		Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.
		Describe any methods used to tabulate or visually display results of individual studies and syntheses.

Section and Topic		Checklist item
		Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.
		Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).
		Describe any sensitivity analyses conducted to assess robustness of the synthesized results.
Reporting bias assessment		Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).
Certainty assessment		Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.
5. RESULTS		
Study selection		Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.
		Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.
Study characteristics		Cite each included study and present its characteristics.
Risk of bias in studies		Present assessments of risk of bias for each included study.
Results of individual studies		For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.
Results of syntheses		For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.
		Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.
		Present results of all investigations of possible causes of heterogeneity among study results.
		Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.
Reporting biases		Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.
Certainty of evidence		Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.
6. DISCUSSION		
Discussion		Provide a general interpretation of the results in the context of other evidence.
		Discuss any limitations of the evidence included in the review.
		Discuss any limitations of the review processes used.
		Discuss implications of the results for practice, policy, and future research.

Section and Topic		Checklist item
7. OTHER INFORMATION		
Registration and protocol		Provide registration information for the review, including register name and registration number, or state that the review was not registered.
		Indicate where the review protocol can be accessed, or state that a protocol was not prepared.
		Describe and explain any amendments to information provided at registration or in the protocol.
Support and funding		Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.
Competing interests		Declare any competing interests of review authors.
Availability of data, code and other materials		Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.

1.2. The PRISMA diagram

The diagram provides a flow chart showing how the search for relevant studies was undertaken. https://www.prisma-statement.org/PRISMAStatement/FlowDiagram.aspx



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

1.3. GRADE checklist for quality assessment of included studies

https://bestpractice.bmj.com/info/toolkit/learn-ebm/what-is-grade/

https://training.cochrane.org/introduction-grade

The GRADE checklist is a guide to forming a judgement on the strength of evidence presented in a study, and the certainty that the study's conclusions are true. Randomised controlled trials are assumed to provide a high quality of evidence, from which they may be marked down using the GRADE questions. Conversely, observational studies start from the assumption of a low level of quality and can be marked up using the GRADE questions.

GRADE questions

Issue to be judged	Questions to be considered
Risk of bias	Does the study design, size or duration weaken the conclusions?
Precision	Is the accuracy of the results poor? Are the confidence intervals wide?
Consistency	Are the results consistent across all of the study outcomes? Are the results consistent with other similar studies?
Directness	Is the study directly answering the research question being investigated? Does the study provide a PICO?
Publication bias	Is it likely that the paper has been published because it has statistically significant results?
Magnitude of effect	Is the size of the effect significant in the context of the size of the population?
Dose-response gradient	Are the effects proportionate across the levels of the variables studied?
Effects of residual confounding	How are potentially confounding variables accounted for in the results if they cannot be controlled?

GRADE rating of a study

Certainty	*What it means*
High	The reviewer has a lot of confidence that the true effect is similar to the estimated effect
Moderate	The reviewer believes that the true effect is probably close to the estimated effect
Low	The true effect might be markedly different from the estimated effect

Very low	The true effect is probably markedly different from the estimated effect

2. Conducting a review of reviews

2.1. AMSTAR-2 checklist for quality assessment of included systematic reviews

The AMSTAR-2 grading systems is a method for making an assessment of the quality of a systematic review.

Ref https://www.bmj.com/content/358/bmj.j4008

A 16-item set of questions should be applied to reviews of systematic reviews, shown in the table below. Seven of these are considered critically important (underlined) and are taken account of in the summary grading.

Questions to be asked	
1. Did the research questions and inclusion criteria for the review include the components of PICO?	
2. Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significantdeviations from the protocol?	
3. *Did the review authors explain their selection of the study designs for inclusion in the review?*	
4. Did the review authors use a comprehensive literature search strategy?	
5. Did the review authors perform study selection in duplicate?	
6. Did the review authors perform data extraction in duplicate?	
7. Did the review authors provide a list of excluded studies and justify the exclusions?	
8. Did the review authors describe the included studies in adequate detail?	
9. Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?	
10. Did the review authors report on the sources of funding for the studies included in the review?	
11. If meta-analysis was performed, did the review authors use appropriate methods for statistical combination of results?	
12. If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?	
13. Did the review authors account for RoB in primary studies when interpreting/discussing the results of the review?	
14. Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?	

15. If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?	
16. Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?	

AMSTAR-2 rating of the quality of a review

High	*No critical weaknesses and zero or one non-critical weakness*
Moderate	*No critical weaknesses but more than one non-critical weaknesses*
Low	*One critical weakness, with or without non-critical weaknesses*
Critically low	*More than one critical weakness with or without non-critical weaknesses*