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Fiscal and pricing policies to improve public health: a review of the evidence

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Executive summary

Fiscal and pricing policies have been shown to be effective in promoting healthy behaviours, as exemplified by the widespread use of commodity taxation on alcoholic beverages and tobacco, and increasingly on sugar-sweetened beverages, in many countries at all levels of income and development (1). Most fiscal policies have the potential to change individual patterns of consumption, and some of them can do it in a targeted way, for instance by altering the prices of specific products at the point of consumption through excise or sales taxes, or through product subsidies. Similar impacts can be achieved with regulatory policies affecting product prices (alcohol minimum pricing is an example). For this reason, certain fiscal policies and pricing policies have been viewed as potential public health interventions and some of them are being used extensively and predominantly for that purpose at the present time (2).

In England, fiscal policies that have a potential to improve health include alcohol and tobacco, betting and gambling duties, vehicle and air passenger duty (3) but there is scope for further fiscal and pricing policy action to improve public health.

Reviewing the evidence on existing and modelled fiscal or pricing intervention for health purposes in other countries may help inform policy makers and government in England on the best opportunities to shape the environment and the population's health-related behaviours.

This report summarises the findings from a review of published and grey literature on fiscal or pricing policies that had an impact on health, or a health-related proxy outcome in OECD countries. Information on relevant policies was extracted into a pre-determined framework to enable comparisons across policy areas, populations and target commodities. The nine policy areas of interest consisted of

- Diet and obesity
- Physical activity
- Environment
- Housing
- Gambling

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- Healthy workplaces
- Secondary prevention activities such as attending health screens, uptake of immunisations and prenatal care services

However, incentives that target healthcare providers, such as pay-for-performance and other incentive schemes were not in the scope of this review.

Given the large body of work and the recent reviews in the field of fiscal and pricing policy for tobacco and alcohol (4, 5), the conclusions of which still hold, it was not necessary to replicate searches, therefore searches have been conducted on specific policies of interest:

- Tobacco:
 - Taxation of e-cigarettes (with a focus on VAT reduction as an incentive to switch)
 - Minimum unit pricing for cigarettes/packs
 - Incentives to promote smoking cessation in pregnancy / in low socio-economic populations
 - Hypothecation of a tobacco industry levy for smoking cessation activities (with a special focus on France and USA where this is known to have recently been implemented)
- Alcohol:
 - Fiscal and pricing policies to promote consumption of lower-strength alcohol (ie volumetric taxation)
 - Evidence of alcohol duty policy outside of the EU
 - Experience of minimum unit pricing outside the UK (after 2016)

From 10,114 unique abstracts and information sources, we identified 261 publications providing information on 234 fiscal and pricing policies or interventions. Of these:

- 117 covered diet and obesity (of which 9 overlapped with healthy workplace policies)
- 29 were aimed at promoting physical activity (of which 2 overlapped with environmental policies and 5 overlapped with healthy workplace policies)
- 14 were environmental policies (2 of which overlapped with physical activity policies)
- 15 aimed at improving housing conditions
- 4 were policies on gambling

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- 24 were policies promoting healthy workplaces (5 overlapping with physical activity, 2 with secondary prevention activities and 9 overlapping with diet and obesity policies)
- 18 promoting secondary prevention activities (2 overlapping with healthy workplace policies).
- the targeted tobacco and alcohol searches yielded 13 reports on tobacco policies and 18 reports on alcohol policies

The type of fiscal or pricing policy varied across policy areas: where overconsumption of an unhealthy commodity (such as tobacco, alcohol and a less healthy diet) is the cause of ill-health, fiscal strategies were used as disincentives for consumption through taxation and in a few cases included regulations that would result in price increases. In other policy areas, the focus was largely on subsidies and incentives to promote the uptake of healthier behaviours (for example for physical activity, healthy workplaces, and secondary prevention) or exposure to healthier environments (such as for the environment or housing policy areas).

The policies that provided a strong indication of an impact on health were mainly taxation policies in the field of diet and obesity or alcohol, or subsidies for housing. Far fewer studies in the environment and physical activity fields reporting health impacts. In contrast, only one or two studies from the fields of gambling, healthy workplaces, secondary prevention activities and tobacco provided any direct health impacts, instead focussing on outcomes such as changes in physical activity levels, dietary intake, smoking rates, or other proximal outcomes. In the case of the gambling literature, the outcomes were indeed very distally related to health, as no impacts on mental health were reported, and instead the only impacts recorded were changes to betting behaviour and value and frequency of gambling, making it very difficult to draw any strong conclusions in this field.

Less than a third of intervention studies reported health impacts for the policies examined, including numbers of disease cases or deaths avoided, quality-adjusted life years, disability-adjusted life years (66/234). The remainder only reported on intermediate outcomes, which were on the pathway to health.

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The majority of intervention studies/policies which reported a health impact consisted of taxation, with 15 consisting of subsidies, while only a few considered joint taxation and subsidies, or financial incentives. Almost all analyses of financial incentives reported proxy outcomes. It should be noted that when a health impact was reported, it was almost always a significant, positive impact on health. Of note also is that, the vast majority of the health impacts reported came from modelling studies. This is likely because health impacts take time to manifest, and modelling studies consider longer timeframes, but also integrate the impact on health of observed changes in behaviour as a result of policies. However, robust modelling studies, of which there were many, are useful to add to the case for taxation policies.

The goals of fiscal and pricing policies examined here can largely be categorised into three aims: to have a positive impact on health, to raise revenue or to reduce inequalities.

Key conditions for fiscal and price policies to generate further significant health impacts are as follows:

- the risks associated with harmful consumption behaviours should be significant and widespread;
- it should be possible to alter prices by a relatively large margin, or consumption should be very responsive to price changes (elastic demand);
- there should be significant scope for an expansion of existing fiscal and price policies or for introduction of new ones

Tax policies targeting specific forms of consumption can generate significant additional revenues when the following conditions occur:

- the taxed products are widely consumed;
- the prices of taxed products are high (for ad valorem taxes), or it is possible to set large ad quantum taxes;
- the consumption of the taxed products is not very responsive to price changes (inelastic demand), or it is possible to limit opportunities for substitutions by consumers;
- in addition, there should be significant scope for an expansion of existing fiscal and price policies or for the introduction of new ones (assuming that only soft earmarking is considered, as discussed above).

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Fiscal and price policies tend to have progressive health impacts because the consumption of unhealthy products tends to be more concentrated in disadvantaged socioeconomic groups, and because the latter groups tend to be more responsive to financial incentives (1). However, the use of fiscal and price measures aiming at increasing the price of commodities has always found a limit in the potential for regressive financial impacts.

Depending on the goal or goals of interest, different policy strategies may be more successful, and in some cases the goals and strategies to achieve these will be in conflict with one another, with some trade-offs required to achieve multiple goals with the same policy.

Glossary

Ad valorem tax	The amount of tax paid is proportionate to the value of the asset being taxed
Ad quantum tax	A fixed amount of tax is levied per unit of the product, which means that this is a tax on the volume of sales
Deadweight loss of taxation	A measurement of how far taxes reduce the standard of living among the taxed population
Fiscal policies	Policies which include both revenue raising measures (typically indirect taxes) and expenditure measures (product subsidies) that may alter the prices of products or services whose consumption has an impact (positive or negative) on the health of consumers
Pricing policies	Policies that alter the prices of products
Price elasticity	Measure of the responsiveness of demand after a change in a product's own price. If the demand of a product/service is elastic, it means that a price change will lead to a more than proportional change in demand. If the demand of a product/service is inelastic, it means that a price change will lead to a less than proportional change in demand.
Cross-price elasticity	Measure of the responsiveness of demand for one product/service after a change in the price of another product/service
AUD	Australian dollar
CFTC	Canadian Children's Fitness Tax Credit
DALYS	Disability-adjusted life years
F&V	Fruit and vegetables
GINA	Global database on the Implementation of Nutrition Action
HALY	Health-adjusted life expectancy
MUP	Minimum unit pricing (a direct price control set by government aimed at preventing the sale of alcohol below a certain price)
NCD	Non-communicable disease
OECD	Organisation for Economic Co-operation and Development
PM2.5	Particulate matter of diameter size < 2.5 µm
QALYS	Quality-adjusted life years

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RCT	Randomised controlled trial
SDIL	Soft Drinks Industry Levy
SES	Socio-economic status
SSB	Sugar-sweetened beverage
VAT	Value-added tax
WCRF	World Cancer Research Fund

Introduction

Non-communicable diseases (NCDs) have risen significantly over the past decade. They are associated with unhealthy behaviours and environmental risk factors and can have a substantial impact on the welfare of individuals, as well as causing a large economic burden through loss in productivity and high levels of healthcare and social care expenditure. However, NCDs can be avoided or delayed through early intervention and population wide approaches.

Fiscal and pricing policies have been adopted globally to provide financial incentives aimed at promoting healthy behaviours, and/or discouraging unhealthy ones. Fiscal policies are defined in the report to include both revenue raising measures (typically indirect taxes) and expenditure measures (product subsidies) that may alter the prices of products or services whose consumption has an impact (positive or negative) on the health of consumers. In addition to using fiscal levers, governments can use regulation to alter the prices of such products, which is what we identify in this report as pricing policies. Strong evidence now points at the effectiveness of influencing people's behavioural choices by using financial incentives (6-10). Fiscal and pricing policies can have a range of beneficial impacts. For example, they can signal the healthiness of a behaviour, and can modify individual behaviour, like encouraging the uptake of greater levels of physical activity, the consumption of a healthier diet, or a reduction in smoking. In the case of taxes, fiscal policies can generate revenue, which can be allocated to fund public health activities. In addition, fiscal and pricing policies can affect the population's health by encouraging consumer and industry action and product modification, which ultimately can influence a population's exposure to a risk factor, see for instance the industry reformulation in response to the recently implemented Soft Drinks Industry Levy (SDIL) in the UK (11).

Many countries and other geographical locations have implemented fiscal and pricing interventions in the past, with varying levels of success in changing behaviour and improving population health. This report aims to provide a comprehensive review of the available evidence and experience of fiscal and pricing policies aimed at improving health across OECD countries (inclusive of England/ the United Kingdom). A specific

focus is placed on nine policy areas which are all linked to NCDs: i) diet and obesity, ii) physical activity; iii) environment; iv) housing; v) gambling; vi) healthy workplace; vii) secondary prevention; viii) tobacco; and ix) alcohol. For each policy area, findings from the literature review are summarised within a predetermined framework and accompanied by a case study that provides in-depth insights into one particular policy/intervention.

This report comes at a time that sees the United Kingdom working towards withdrawing from the European Union. This means there may be the opportunity to amend some policies that were previously restricted by EU legislation, and provide an opportunity for strong public health policy, following a Health In All Policies approach (12). Therefore, this report can provide a useful guide in supporting policy-makers to improve population health.

Methods

Objectives

The aim of this project was to identify and assess potential fiscal or pricing policies implemented and modelled both in the UK and other OECD countries that could be implemented on different types of goods and services, and ultimately improve health outcomes in England. The review planned to collect literature from modelling studies, empirical and qualitative evidence. This would then highlight where there is potential to improve health through fiscal or pricing policies, while considering the policies' potential impacts on other areas, such as inequalities, government revenues etc. Policies in the scope of the review include both taxation and incentive levers, as well as policies that regulate the price of a good or service.

Approach

The approach to this work is summarised in Figure 1 and described below. Briefly, it consisted of collecting evidence through a review of grey and peer-reviewed literature and through contact with national and international public health policy experts. All sources and references were screened for relevance to the project. A framework was designed with the guidance of the project Steering Group to structure the collection of information for each fiscal and pricing policy, and this was created in MS Excel, see Appendix A for an example of the format and fields included. Information from each relevant policy was extracted into the relevant field of the framework, to allow cross-policy comparison and analysis. For each policy area, the information on policies was compared and summarised according to policy type, policy target, population targeted and impacts reported (eg the impact on population health, health inequalities and revenues).

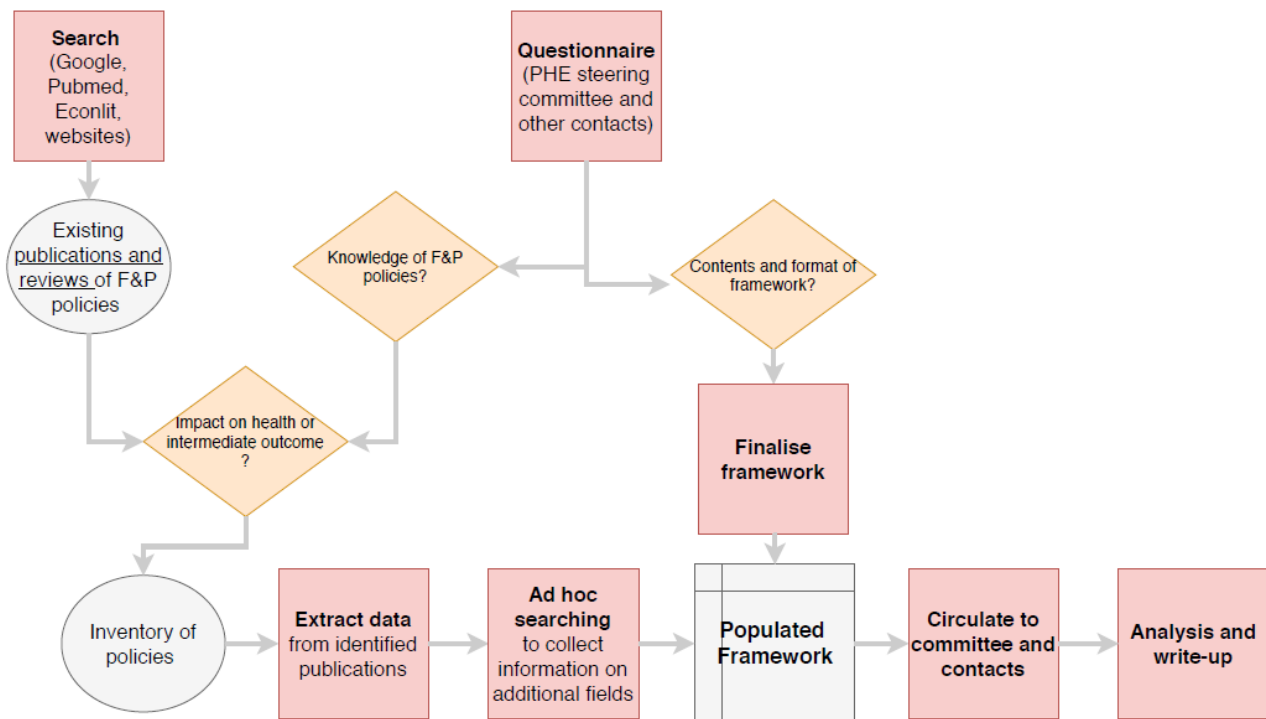


Figure 1. Flowchart of the approach and methodology of the review.

Red shading indicates tasks that were undertaken, orange shading indicates questions asked or criteria to be filled and grey shading indicates information collected.

Search strategy

The policies included in this review were selected from areas related to public health, and were determined in consultation with the Steering Group:

- Diet and obesity
- Physical activity
- Environment
- Housing
- Gambling
- Healthy workplaces
- Secondary prevention activities. These include activities such as attending health screens, uptake of immunisations and prenatal care services

However, incentives that target healthcare providers, such as pay-for-performance and other incentive schemes were not in the scope of this review.

In addition, information on specific questions and types of policies was collected for tobacco and alcohol. The specific policies of interest for tobacco and alcohol were defined by consulting internally with PHE members and the Steering Group. Given the

large body of work and the recent reviews in the field of fiscal and pricing policy for tobacco and alcohol (4, 5) it was not necessary to replicate these searches.

Furthermore, the conclusions from previous reviews on fiscal and pricing strategies available for the control of tobacco and alcohol consumption still hold, so there is little value in repeating these in this review.

The specific topics of interest in tobacco and alcohol fiscal and pricing policies were:

Tobacco:

- Taxation of e-cigarettes (with a focus on VAT reduction as an incentive to switch)
- Minimum unit pricing for cigarettes/packs
- Incentives to promote smoking cessation in pregnancy / in low socio-economic populations
- Hypothecation of a tobacco industry levy for smoking cessation activities (with a special focus on France and USA where this is known to have recently been implemented)

Alcohol:

- Fiscal and pricing policies to promote consumption of lower-strength alcohol (ie volumetric taxation)
- Evidence of alcohol duty policy outside of the EU
- Experience of minimum unit pricing outside the UK (after 2016)

The searches for information on relevant fiscal and pricing policies were conducted separately for each policy area, resulting in seven separate literature and evidence searches, along with two more targeted searches for specific questions in relation to tobacco and alcohol fiscal and pricing policies. These reviews followed the same method as outlined for the policies above, but were specifically targeted to answer questions of interest internally to PHE and the Steering Group (see inclusion criteria and exceptions fields in particular for these).

Searches on Medline via PubMed and Econlit for peer-reviewed literature were conducted on all policy areas. National and international websites and databases were also searched for grey literature and further information. See Appendix B for a list of sources searched and detailed search strategies. All search results were imported into a reference manager to automatically de-duplicate and facilitate screening. When ad-

hoc web-searches were performed for included policies or studies revealed additional sources of information, these were added to the reference manager database, and screened through the same process as other references (checked for an existing duplicate, examined for relevance and data extracted into the framework). Similarly, the publications provided by the external contacts were also included into the reference manager database, and considered for eligibility like any other reference.

Eligibility criteria

Sources of information on policies, and policies described were considered eligible and in scope, if they met the inclusion criteria listed below in Table 1. These were refined after consultation with the project Steering Group.

Table 1. Eligibility criteria for policies/publications relevant to the evidence review

Publication years	From 2008 to 2018 (see exceptions field for notable exceptions to this criterion).
Evidence type	Evaluations of the impact of actual policies, ie empirical evidence, studies, case studies or modelling studies that evaluate the impact of hypothetical policies, and reviews or systematic reviews of both types of evidence The information extracted on each study within a systematic review was reviewed for relevance and eligibility into this review. The information available on eligible studies was then extracted from the systematic review report.
Policy outcome	Policies were only eligible for inclusion if outcomes were assessed and reported for either health impacts or an intermediate impact (eg change in consumption, exposure, behaviour). See exceptions for the outcomes selected for environment fiscal and pricing policies.
Policy scale	National fiscal and pricing policies. However, due to interest in policies in cities and the devolution process, regional or local experience was included if the policy was considered to be scalable.
Multi-policy	Combined or linked interventions and policies were only included where the policy effect could be easily separated for analysis.
Countries	Evidence from the UK and other OECD countries, so that the evidence is comparable to the UK (see exceptions below for clarification).
Language	Publications in English, French, Spanish, Italian, German and Swedish (language abilities of the research team).
Exceptions	Publication year:

	<ul style="list-style-type: none">• Publications on sugar sweetened beverage (SSB) taxation were only included if published from 2016 onwards, so as not to replicate work from the PHE evidence review on fiscal measures published in 2015 (7, 8).• Similarly, publications on Minimum Unit Pricing (MUP) for alcohol beyond the UK were restricted to 2016 onwards, so as not to duplicate and repeat much of the evidence that has gone into the MUP decision in Scotland. Other alcohol policy searches included literature from 2008 onwards.• Searches for the targeted tobacco policies were conducted from 2010 onwards – this was based on the evidence having been reviewed in 2010.• Due to small numbers of publications identified, the search for fiscal and pricing gambling policies was extended back to 2000 <p>Countries:</p> <ul style="list-style-type: none">• Evidence on the tobacco industry levy experience was limited to the USA and French context, as these were of particular interest to PHE• While OECD countries were a criterion for inclusion, a few select policies identified in non-OECD countries were included as their specific policy settings were relevant to the UK context. For example, experiences in Brazil were considered comparable to other experiences in Mexico and Chile and were therefore included. <p>Policy outcome:</p> <ul style="list-style-type: none">• For environment policies, policies on air pollution were only eligible for inclusion if they focused on pollutants with proximal impact on health. Policies focussing on greenhouse gas emissions or carbon pricing were therefore excluded.
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Contacting experts

Experts in the field of fiscal and pricing policies for the improvement of health were a secondary source of data collection. We contacted relevant national and international individuals including in academia, policy and government, and authors of relevant reports and publications with a request to circulate any published or unpublished information, reports, or other contacts that might support the review. See Appendix C for a short summary of the results of this contacting exercise.

Review process

Titles and abstracts of all sources and references identified were screened by one reviewer, to exclude any obviously irrelevant publications and materials. All relevant sources were then screened in full-text by one reviewer for eligibility for this review. Information was extracted from included publications or other information sources into the framework, using MS Excel, and ad-hoc internet searching was conducted to identify any additional information, in particular about the policy's context.

Framework design

The framework was designed to help collect, standardise, organise and analyse information on the relevant fiscal and pricing policies designed to improve public health. Consensus on the contents of the framework was obtained through consultation with health economists, policy analysts or advocates and members of the project steering committee who could be potential users of such a framework.

The dimensions of the framework were split into three sections: policy description, policy outcomes and policy context (see Appendix A for a full template of the framework).

Policy description

- the policy name (if named),
- the type of evidence (either modelling study, randomised control trial or implemented policy assessment),
- the policy owner,
- the type of fiscal or pricing mechanism (price increase such as a tax, or price decrease such as a subsidy)
- further details of the intended mechanism and the target risk factor or commodity of the policy.
- additional information was collected to describe the policy, such as implementation year, the target geography and population, the timeline to achieve impacts (short, mid or long term elasticities), the timeline of the evaluation/outcome measurement, and any details on the logistics of implementing or passing the policy (eg cost).

Policy outcomes

The second section of the framework collects information on any impacts of the direct health impacts of the policy such as cases of disease or deaths avoided, quality adjusted life years (QALYs) or disability-adjusted life years (DALYs) gained. We also collected information on impacts that were not directly related to health, but that were on the pathway to health. These intermediate, health-related proxy impacts included, for example, dietary intake of nutrients or foods, minutes of physical activity reported, air pollutant emissions, uptake of immunisation, smoking cessation rates. This list is not prescriptive as the impacts reported varied by study. In addition, information on cost-effectiveness and any information on inequality/distributional effects as well as non-health related impacts such as revenue, and societal impacts such as school attendance were collected.

Policy context/other

To better understand the impact of policies already implemented we collected available information on the context around these policies including:

- anecdotal (often subjective) political acceptability of the policy at the time
- the main proponents or opponents of the policy
- any resulting changes in public perception
- what tools and building blocks were used to influence public perception and the implementation of the policy

The framework was structured as a database in MS Excel, so that each policy was entered as a row, and the framework fields listed as columns.

Data extraction and use of the framework

Data entry was standardised as much as possible using drop-down options, so the framework database is searchable using filters applied on one or a combination of fields. When a source or publication provided information on the impact and outcomes separately for several policies (eg separate scenarios in a modelling study, examples of the same policy in a different country or different treatment arms in an RCT) these were extracted into the framework into different rows, and treated as separate policies or studies.

When a policy reported outcomes that related to two separate policy areas (one example being environmental policies that influenced physical activity), the policy was included in both areas, and was marked as such in the framework.

Policies were collected from a range of countries and years, and costs were reported into the framework as they were, to allow conversion in the future if needed. However, costs reported in this report were converted to GBP using the CCEMG - EPPI-Centre Cost Converter (13) in the original cost year, but the original cost is still reported to allow different conversions if required, or updating to a different year if necessary.

There are three main ways to analyse the data collected in the framework (see Appendix D for a detailed user guide):

- 1 Look across all policy areas and examine the impact of a specific fiscal and pricing policy type and mechanism (eg the impact of all forms of taxation across policy areas).
- 2 Focus on a policy area with a specific target commodity or behaviour (eg diet/obesity, tobacco, alcohol, gambling) and look through the various policies that work in each one, across all types of fiscal policies.
- 3 Look within a specific field (housing, prevention, workplace) and look at the impact of fiscal and pricing policies on a range of target commodities and behaviours.

The overall yield of this scoping review is summarised below, broken down by the numbers of publications and studies identified for each policy area, the type of evidence (implemented policy assessment, RCT, modelling study) and the countries studied. The type of policies (taxes, subsidies, price changes) and policy targets across all policy areas are described. In further sections, evidence for each policy area is available separately, and illustrates the type of evidence of each one using a short summary of one policy selected as a case study to exemplify the types of policies in each area, and provide some insights into policies that may be of interest in the UK context.

Results

From 10,114 unique abstracts and information sources, we identified 261 publications providing information on 234 unique fiscal and pricing policies or interventions (Figure 2).

Of these:

- 117 covered diet and obesity (of which 9 overlapped with healthy workplace policies)
- 29 were aimed at promoting physical activity (of which 2 overlapped with environmental policies and 5 overlapped with healthy workplace policies)
- 14 were environmental policies (2 of which overlapped with physical activity policies)
- 15 aimed at improving housing conditions
- 4 were policies on gambling
- 24 were policies promoting healthy workplaces (5 overlapping with physical activity, 2 with secondary prevention activities and 9 overlapping with diet and obesity policies)
- 18 promoting secondary prevention activities (2 overlapping with healthy workplace policies)
- the targeted tobacco and alcohol searches yielded 13 reports on tobacco policies and 18 reports on alcohol policies

While this section provides an overall summary of the evidence identified in this review, more detail around the study design and results of each study/intervention can be found in the framework that accompanies this report.

The majority of policies identified were based in the USA (86/234 (37%)), with the remaining policies identified from a range of countries: 48/234 (21%) from Australia/New Zealand, 37/234 (16%) from the UK, and a smaller numbers of studies and policies each located in Canada, Western European countries, and other countries such as Mexico, Brazil and Singapore.

Across all policy areas, taxation was the most common type of policy (77/234 reports), followed by subsidies (73/234) and financial incentives (50/234), along with less common types of policies or combinations (such as combined taxation on some unhealthy products and subsidies for healthy products), or price increases such as minimum unit pricing and congestion charging.

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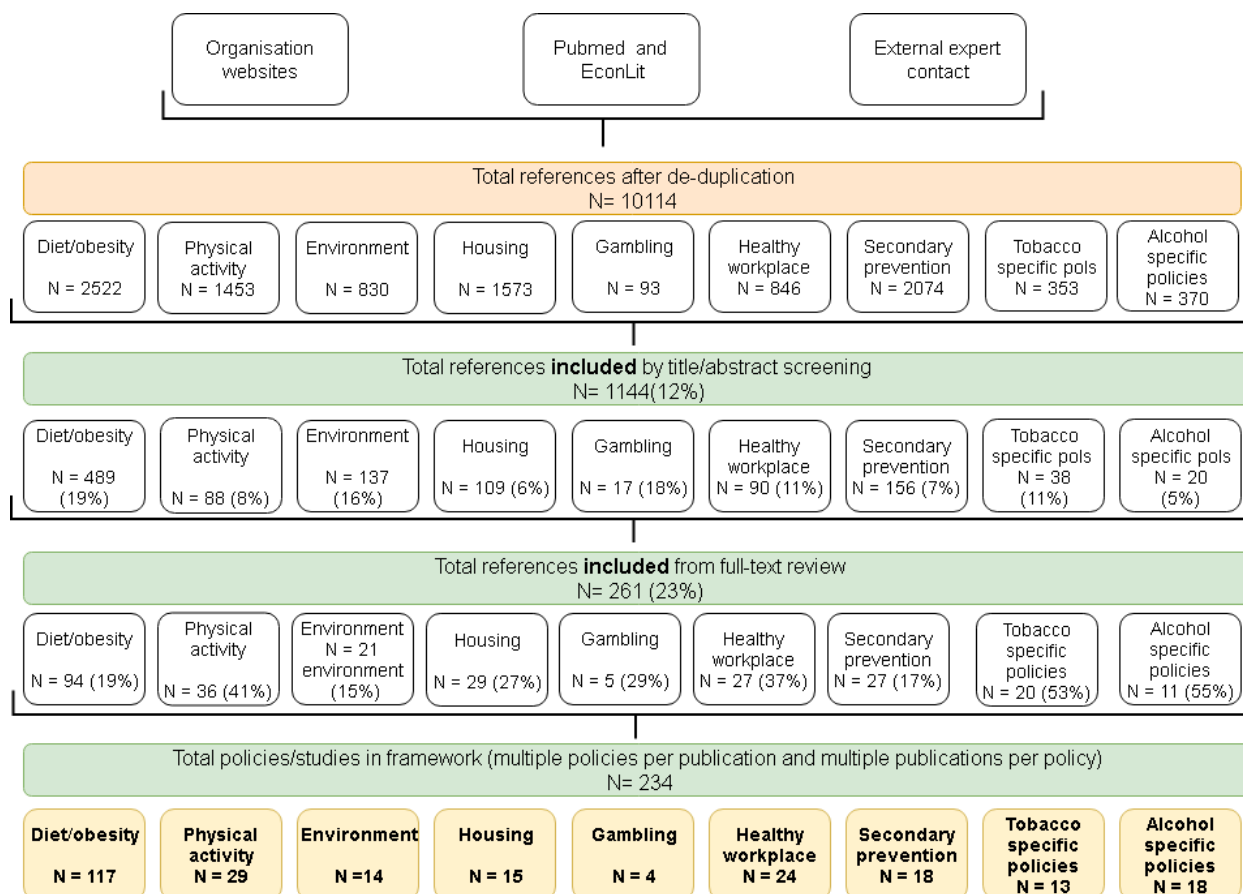


Figure 2. Flowchart of evidence review results

Note: The number of references included and the total number of policies identified does not match as some references provided information on multiple policies, while conversely, some policies drew on information from several references.

Table 2 below describes the results from individual policy areas in more detail, with the numbers indicating the number of policies/studies for each policy area. The colour coding qualitatively indicates the overall impact on health, and should be interpreted with caution, as it is in some cases subjective. It is not possible to combine the health and proxy outcomes quantitatively within different policy areas and policy types, as these vary widely. Please note that a narrow search was applied for tobacco and alcohol policies so to reduce replication of recent evidence reviews (4) and government strategies (14), which had concluded that taxation and monitoring of illegal markets were the most effective at reducing uptake and encouraging cessation of smoking and risky alcohol consumption.

Table 2. Summary of the evidence captured in the review by policy area

Policy Area / commodity (N policies)	Tax	Charge	Tax & subsidy	Subsidy	Cash incentive	Other
Diet/Obesity	50		15	33	6	3
Single nutrients	16			4		2 cap & trade; lowering floor price)
Single foods	21		1	14		
Multiple dietary targets	11		14	7	2	
Dietary behaviours				10	3	
Other	2			2	1	1 tax exemptions
Physical activity	5			10	14	
Fuel price	5					
Active travel				5	1	
Physical activity levels				1	9	
Physical activity programme				4	4	
Environment	8	6				
Congestion		4				
Emissions	1					
Fuel Price	3					
Heating (biomass use)	1					
Travel	3	2				
Housing				15		
Access to safe accommodation				6		
Housing conditions				9		
Gambling						4
Betting size						3 betting size limit
Revenue						1 revenue redistribution
Workplace interventions				8	16	
Fruit and Veg./Healthier food				2	1	
Multiple health behaviours				1	7	
Multiple health screens				2	1	
Occupational health				1		
Physical activity				1	4	
Smoking					3	
Weight loss programme				1		
Secondary prevention				2	17	
Diabetes control					1	
Health screens				1	10	
Immunisation				1	2	
Metabolic health					1	
Prenatal health					2	
Smoking					1	
Tobacco update						
Minimum unit pricing						3 minimum pack price
Smoking cessation				9		
Tobacco industry levy	1*no outcomes, for information					1 Hypothecation of tobacco industry levy
Alcohol update						
Minimum unit pricing						2
Lower strength alcohol	16					

Note: Where no numbers are included, no evidence was found for the relevant policy area/commodity and policy type.

 : Majority of publications report some positive impact on health or proxy health outcomes.

 : The publications report a mixed impact on health or proxy health outcomes, ie positive, negative or no impact found

Obesity and diet policy area

We extracted 117 separate policies (9 of which overlapped with healthy workplace policies (15-23)) from 94 papers in the field of diet and obesity (15-109). The majority of studies and policies identified were based in the USA (37/117), followed by Australia/New Zealand (20/117) and the UK (16/117). Other countries with multiple studies included France, Brazil, Mexico, the Nordic countries, while individual studies were from countries such as Barbados, South Africa, India (not OECD countries but interesting examples of policies) and Western European countries. The majority of policies and studies were set at the national level (91/117) and the remainder were set at either the regional or local level.

These can be broadly categorised into 50 policies increasing prices (taxes) and 47 decreasing prices (37 reporting on subsidies and 10 on incentives), as well as 15 publications combining both taxation and subsidies for different commodities in an effort to promote a healthier diet. Three separate publications reported on alternative fiscal policies, including one which models the impact of a cap and trade approach (comparable to emissions trading in the environment field aimed, at reducing added sugars in the US food supply); another report examined the impact of lowering the floor price (government-imposed price limit on how low a price can be charged) for sugar and another examined the impact of supermarket tax exemptions.

The commodities and behaviours targeted ranged from individual nutrients (eg sugar, fat, sodium), individual foods (eg fruit and vegetables, sugar-sweetened beverages, milk) to combinations of both (eg sugar taxation combined with fruit and vegetable subsidies) and more broadly targeting specific dietary behaviours (school breakfast and lunch, healthier/less-healthy dietary patterns, and weight loss directly). Broadly speaking, nutrients, foods and behaviours considered less healthy (eg sugar, fat, sugar-sweetened beverages and so called “junk foods”) were targeted through taxes, while healthier foods and broader dietary patterns (eg fruit and vegetables, whole grains) were promoted using subsidies, with two studies providing information on the impact of sugar price reduction.

The majority of studies were modelling studies of hypothetical policies (74/117) with the rest being impact assessments of existing policies (29/117) using epidemiological and econometric methods, and fewer reports of smaller scale RCTs (9) focussing primarily on supermarket-based subsidies and school breakfast subsidies.

Overall, policies involving taxation of less healthy nutrients or foods showed more consistent, positive outcomes, however, most studies reported proxy/intermediary outcomes (eg consumption of 'unhealthy' food) (77/117) while only a small proportion reported health outcomes (eg, disease cases or deaths avoided, DALYs). Of the policies reporting a direct health impact, the majority (32/38) were positive, while two found negative impacts on health, and the rest (6) found null or mixed health impacts. It should be noted, however, that the majority of reports of direct health impacts came from modelling studies and these are subject to a range of potential biases: modelling studies are limited by the model structure, the input data and parameters and the assumptions made. However, they are able to link to theoretical longer-term health outcomes due to indirect assumptions of the impact of behaviour on health, and the longer modelling timeframes, compared with RCTs or observational studies of existing studies, which usually report proxy outcomes, rather than health.

These study designs, however, are also limited by the potential for responder bias, shorter time frames, methodological and collection differences and smaller samples representing the results. Empirical evidence such as this came in large part from econometric analysis of sales, as well as small scale studies which sampled a very distinct population to look at the longitudinal impact of a policy on proxy or health outcomes (for example, the many studies conducted to evaluate the impact of the Supplemental Nutrition Assistance Program (SNAP, also commonly known as food stamps) and Women, Infants, and Children (WIC) programmes in the USA.

The vast majority of studies assessing nutrient, food and behavioural taxes (which consistently showed a positive impact on health or a proxy outcome) used modelling approaches, with a select number of reports presenting empirical impact assessments of taxes implemented in countries, for example, the Danish fat tax (which was only implemented for a short period of time), the Hungarian "junk food tax" and the Mexican

non-essential food tax (see **Case study**) as well as several SSB taxes. It should be noted that for evidence on SSB taxation, only publications from 2016 were collected (18 separate publications, models or policies), in order to not overlap with the PHE evidence review (7, 8).

Case study

Non-essential energy dense food taxation – Mexico

Batis et al. (2018) (29)

Taillie et al (2017) (100)

Bonilla-Cachin(2016) (36)

What was the policy objective?

- Mexico has one of the highest rates of child and adult obesity in the world, a high prevalence of type 2 diabetes and is the fourth-largest per-capita consumer of energy-dense, non-essential, processed food and drink.
- In 2014, the government introduced an 8% tax on foods classified as non-essential with an energy density $\geq 275\text{kcal}/100\text{g}$, representing 11-18% of the population's average caloric intake: this includes crisps and snacks, candies and sweets, chocolate, puddings, peanut and hazelnut butters, ice cream and ice pops and cereal-based products with substantial added sugar. Alongside this tax, a 1-peso-per-litre sugar-sweetened beverage tax, corresponding to a 10% tax, was introduced.

What did the researchers do and find?

- Using a longitudinal sample of household purchasing data, researchers compared the volume of taxed and untaxed foods purchased in the pre-tax period (2012-2013) to the post-tax period (2014-2015), and investigated differences by socio-economic status, and pre-and post-tax patterns of purchasing of households.
- After 1 year, there was a 5.1% reduction in the volume of taxed foods purchased per month per person compared to prior to the tax's introduction, equivalent to 25g (95%CI: 38) less food or 70 to 110 fewer kilocalories per month per person.
- The impact of the tax varied across socio-economic groups, with low socioeconomic status (SES) households reducing their purchasing of taxed foods by up to 10.2%, medium SES households by 5.8%, and high SES households not changing their purchasing significantly. There was no significant change in purchasing volume of untaxed foods across any socio economic group.
- In 2015, after 2 years, the post-tax decline in the proportion of taxed foods purchased was 6% beyond trend (or what would have been predicted from baseline "no intervention" trends). Taxed food purchasing was most reduced in "unhealthy" purchasing households (low volume of untaxed, high volume of taxed products purchased) with taxed food purchasing reduced in these households by 12.3% of pre-tax levels. This reduction varied according to the volume of purchasing pattern: those purchasing low levels of both product categories (5.3% reduction) and high levels of both product categories (4.4% reduction).
- Decreases in recorded purchasing were reflected in declines in the volume of sales for industries of the taxed products (-5.6% in 2014 and -4.5% in 2015).
- The gross revenue raised specifically collected for the non-essential food tax in 2014 and 2015 was MXN29.6 billion (~ GBP 2.52 billion).

What are the conclusions, strengths and limitations?

- Researchers found a positive effect of Mexico's "junk food" tax continuing into the second year of the policy, particularly in lower SES households and those with the unhealthiest purchasing patterns. These findings are thought to be conservative, as the dataset only represents a subset of all household purchases, and real absolute change in energy intake from taxed food may be larger. However, the study is a comparison between observed consumption and a modelled counterfactual based on an extrapolation of past trends. A potential limitation of the policy is the use of a single energy-density cut-point, without other nutritional attributes, resulting in some unhealthy foods being excluded from the tax base.
- While this evaluation appears to be robust and does show a small reduction in the consumption of unhealthy, energy dense foods, there has been no evaluation of the health impact of this policy yet.

Physical activity policy area

A total of 29 policies/studies were identified in the field of physical activity from 36 publications (110-147). Two of these overlapped with the environment policy area ((114, 121)), and five with the healthy workplace policy area ((110, 111, 120, 124, 126, 135, 136, 141)). Most were forms of financial incentives to promote physical activity, in the form of cash incentives (including vouchers) (14/29) and subsidies (10/29) while the remainder were changes to the tax system (5/29). The setting for these policies or studies were mainly in English speaking countries with 15 in the USA/Canada, 5 in the UK, and the remainder in countries such as Sweden, the Netherlands, Belgium and Singapore. The majority of evidence came from assessment of implemented schemes and policies, through either RCTs or observational studies, while seven hypothetical policies were modelled.

The majority of policies decreased prices and provided cash incentives encouraging participants to meet specified activity requirements, and some of these studies assessed the effects of an incentive gradient directly promoting physical activities. Other policies, both subsidies and cash incentives, promoted participation in activity programmes (walking groups, gym/fitness attendance, school sports programmes) or active commuting and travelling. Policies that increased prices focused on fuel taxation, which influenced active travelling and physical activity levels, by making car commuting more expensive and less desirable. Ten policies/studies reported on distributional effects, with only two policies demonstrating a positive or advantageous effect for

disadvantaged groups. The other policies either showed no health impact for different social groups or showed that advantaged socio-economic groups were benefiting from the policy more than the disadvantaged socio-economic groups.

The majority of policies identified reported a positive impact on health or proxy outcome (22/29). It is difficult to identify trends in these impacts on health however, as the policy mechanisms and targets varied across the field of physical activity, from increases in walking associated with bus pass ownership (119, 147), to increase in physical activity levels due to financial incentives for gym attendance (120, 123, 124). In addition, only 11 of the 29 policies were either implemented or modelled on a national scale, making strong conclusions on their larger scale impact difficult. However, overall, the evidence of an impact on health and health-related intermediate outcomes like physical activity levels was strongest for taxation policies and cash incentives. The impact of subsidies to promote the participation in physical activity programmes was more varied, particularly for programmes aimed at children's physical activity, see **Case Study**.

As the majority of the sources on incentives for increasing physical activity were trials, information on how these policies could be scaled up and implemented nationally in a publicly acceptable and cost efficient way is limited. Incentivising physical activity has been shown to improve physical activity levels; however, there are conflicting results on how long increased levels of physical activity can be maintained. Most studies are small-scale cash or voucher programmes, which would need further research to consider how these interventions could be scaled up to the regional or even national level. However, the tax programmes allow analysis at a national level and present considerations based on socio-economic status.

The overlap between physical activity policies and policies related to the environment and healthy workplaces provides support for cross-policy area learning and could strengthen the case for future policies, if positive health and proxy impacts can be demonstrated for more than one area.

Case study

Children's Fitness Tax credit – Canada

Von Tigerstrom et al. (2011) (146)

Nguyen and Grootendorst (2012) (137)

Spence et al. (2010) (143)

Government of Canada. Children's Fitness and Arts Tax Credit. 1 April 2016 (127)

What was the policy objective?

- The Canadian Children's Fitness Tax Credit (CFTC) is a national programme aimed at increasing levels of physical activity in Canada's youth, through a refundable tax credit for child enrolment in physical activity programmes. The national programme grew from provincial policies and was active between 2007 and 2016. The programme allowed a maximum claim of CAD 500 (~ GBP 287) for organised physical activity programmes for children aged less than 16 years (under 18 if the child has a disability). The policy aimed to improve children's participation in sport. However, there was mounting evidence that the policy was ineffective and may have contributed to widening the inequality gap.

What did the researchers do and find?

- The researchers surveyed parents to understand their use or awareness of the CFTC and found that among eligible respondents over half (55%) were aware of the tax credit and a third (33%) planned to claim it in the next tax year.
- 28% of parents from the lowest income quartile had claimed the CFTC in 2007 while 55% of parents from the highest income quartile claimed the credit. There were differences between provinces on what could be claimed, which may have limited participation.
- They analysed individual-level data from the Canadian Community Health Survey (2003- 2011) using time varying effects regression analysis.
- The impact of the policy on physical activity levels was positive in the first year after implementation; however, the magnitude was small, suggesting that the CFTC raised physical activity participation amongst children by only 2 percentage points.
- Finally a difference in differences analysis was conducted confirming that the trend in sports participations between the age groups were similar over time, and the CFTC had no impact in preventing the decline of children's participation in sport over time.
- Research suggests that approximately 1.4 million people used the CFCT and it costs the federal government about CAD 100 million (~ GBP 57 million) in forgone tax revenue annually.

What are the conclusions, strengths and limitations?

- The main findings from the CFTC analysis was that it was ineffective in increasing children's physical activity and that it had a distributional effect. It appears that the tax primarily benefits those who can afford to pay the cost of the physical activity programme up front.
- This tax was implemented in a comparable country to the UK and was long lasting (over 9 years). However, the policy never achieved its aim of improving child physical activity participation and ultimately contributed to inequality due to the rebate nature of the tax credit.

Environment policy area

A total of 14 environment studies were identified from 21 publications (114, 121, 148-166). Two of these overlapped with the field of physical activity((114, 121)). Eight were forms of financial or pricing measures to promote uptake of more sustainable environment activities through taxation and the others were pricing policies/charges. The targeted activities varied across policies and studies, but can broadly be categorised into polices aimed at reducing congestion (4/14), taxing emissions or fuel directly (5/14) or promoting more active methods of travel/lifestyle (5/14). Half of the studies were hypothetical modelling studies and half were assessments of real economic events or historical changes. Four policies were set in the UK, two in the USA and Portugal, and a heavy focus on western European countries for the remainder of the policies. Half of the reports focused on the national level, and the rest were local or regional interventions and policies.

Only four studies reported direct health impacts (see **Case study**) while the rest reported intermediary outcomes such as reduced emissions. Several examples of congestion charge schemes report significant reductions in vehicle circulation and pollutant concentrations (152-154, 161, 164). However, a lack of direct reference to the specific health impacts of environment policies is a gap in the literature and could be a powerful tool for future policy evaluations (163). The lack of knowledge about how environment fiscal and pricing policies directly influence health and the limited information available on the scalability, acceptability, or challenges of implementing such schemes at a national level limit our conclusions from these studies. Environment polices often have a wide scale impact and reflecting the multiple stakeholders in impact reviews/ the academic literature is very important.

Case study

Modelling the cost-effectiveness of fuel taxation – Australia

Brown et al (2017) (114)

What was the policy objective?

- Excise duty is levied on fuel and petroleum products produced or manufactured in Australia, but the country has one of the lowest automotive fuel prices among OECD countries.
- Limited evidence currently exists on the effect of fuel taxation on active transport (increased

walking, cycling and use of public transport) and its potential downstream effects on health.

- Researchers aimed to estimate the health and economic impacts and cost-effectiveness of an intervention to increase fuel excise taxation in Australia.

What did the researchers do and find?

- The literature on the associations between obesity, physical activity, walking or cycling and fuel price or taxation was reviewed.
- Based on the parameters extracted from this scoping review and publically available data on population, diseases and transport, the authors used Markov modelling to estimate the cost-effectiveness of an increase in fuel tax in Australia.
- The intervention modelled was an AUD 0.10 per litre increase (~ GBP 0.05) to the 2010 national fuel excise tax of AUD 0.38 per litre (~ GBP 0.18), which would be applied prior to the addition of the 10% Goods and Services Tax. This higher tax would increase the proportional amount of tax levied as a percentage of total fuel price, but would still put the Australian fuel taxation below that of countries such as Switzerland, and the United Kingdom.
- The impact on mortality and obesity-physical activity-related morbidity was modelled over the life course of the 2010 working age population.
- The implementation cost of this hypothetical increase in fuel taxation was regarded as minimal given current taxation administration and compliance in Australia.
- Over the lifetime, 237 (95% CI 138; 351) health-adjusted life years (HALYs) would be gained, due to fewer road deaths resulting from reduced traffic.
- AUD 2.6 million (95%CI 1.3; 3.9) in healthcare costs would be averted with the new tax increase (~ GBP 1.2 million (95%CI 0.6; 1.8)).
- The intervention would be cost-effective over the lifetime, with a median incremental cost-effectiveness ratio (ICER) of AUD 7,702 (95% CI 1,366; 22,125) cost for every HALY saved (~ GBP 3,540 (95%CI 628; 10,170)). The probability of the intervention being dominant (cost saving) however was only 0.8%.
- Raising the fuel tax to AUD 0.48/L in this intervention would increase walking to access public transport for commuting purposes by an average 90mins per week per person.
- This policy would be revenue generating, with the Australian government standing to collect around AUD 1.7 billion annually in revenue from an AUD 0.10 increase to the national fuel tax.
- The range of results using less conservative but still credible inputs suggests the potential for much larger population health gains (under a 'plausible scenario' 3,181 HALYs gained and AUD 34.2 million (~ GBP 15.7 million) in healthcare cost offsets.
- Authors mention that there could be some distributional effects with lower and middle-income households experiencing greater financial impact.

What are the conclusions, strengths and limitations?

- The increase to Australia's national fuel tax was cost effective and would increase active transport. Reducing the number of cars would also have intermediate health effects, such as reducing air pollution related diseases that were not discussed in the study.
- It is likely that any such intervention would be both politically and socially sensitive so a fuel excise intervention designed to increase rates of active transport would have to overcome significant equity and acceptability challenges. This could occur through reinvestment of taxation revenues into initiatives such as better provision of alternative modes of transport.
- These findings highlight the fact that more research into potential health impacts in the transport planning and policy agenda is required in order for public health considerations to be more comprehensively considered

Housing policy area

A total of 15 policies/studies were identified in the field of housing from 29 publications (167-195). All were forms of financial subsidies. The targets were either to improve housing conditions (9/15), such as increase access to fuel in winter, or facilitate refurbishments to improve heating and housing insulation or to facilitate access to safer or higher quality housing (6/15).

Six studies were based in the USA, with four in the UK, three in Australia/New Zealand, one in Canada and one in Spain. The majority of the studies assessed the impact of existing local schemes (9/15) such as the Moving to Opportunity voucher programme in Georgia, USA (184), while others assessed national or regional schemes (6/15) such as Warm up New Zealand: Heat Smart subsidy (see Case Study).

Subsidies to improve the quality of housing were generally associated with improvements in health and health-related outcomes. Subsidies to improve access to safe housing (for example, in safer areas, or to areas with a higher quality of living than those currently experienced) showed less evidence of a robust effect on health. Some studies showed that being subsidised to move to higher quality areas and housing did little to improve families' nutritional status, or to reduce temporary homelessness and drug use. The outcomes reported ranged widely, from disease and hospitalisation rates, including mental and psychological outcomes (eg reduced stress, depression scores), to QALY gains, through to more specific health-related outcomes such as increases in immunisation rates, nutrition status or risk behaviours (eg unsafe sex, alcohol consumption).

Case study

Evaluation of the Warm up New Zealand: Heat Smart – New Zealand

Healthy Housing He Kainga Oranga "Evaluation of Warm Up New Zealand: Heat Smart (195)

Howden-Chapman et al. (2012) (194)

Grimes et al. (2012) (193)

Healthy Housing He Kainga Oranga (2011) (192)

What was the policy objective?

- New Zealand housing has been widely described as "old and cold". An estimated 84% of dwellings have inadequate insulation. Respiratory and circulatory health conditions make up the bulk of excess winter mortality and hospitalisation and these conditions are closely linked with low

environmental temperature and high humidity.

- Warm Up New Zealand: Heat Smart is a national subsidy programme started in 2009 to encourage insulation and heating improvements to houses built prior to 2000. The interventions including retrofitting ceiling insulation and/or underfloor insulation or moisture barrier. Other measures include draught proofing, hot water cylinder wraps, and pipe lagging; funding for a clean heating device) (such as a heat pump, a wood pellet burner, a modern wood burner or a flued gas heater). Depending on existing characteristics of the house, applications may be for funding for 1) insulation and clean heat, 2) insulation only, or 3) clean heat only. Most houses were eligible for 33% of the total cost up to NZD 1,300 (~ GBP 580) of insulation and NZD 500 (~ GBP 223) for clean heating, except houses where inhabitants were on low incomes or state benefits, in which case up to 60% of the total cost of insulation and up to NZD 1,200 (~ GBP 536) for clean heating were available.
- Up to May 2010, 46,655 dwellings were treated under the programme. Funding ceased in June 2013. The Ministry of Economic Development commissioned a full and independent evaluation into the health impacts and cost-effectiveness of the scheme.

What did the researchers do and find?

- Health impacts were determined from a retrospective cohort study. Reduced mortality is the largest benefit of the intervention. The scheme prevented about 18 (95%CI 0; 45) deaths among those aged 65 and over who had previously been hospitalised with circulatory disease. This is equivalent to an annual reduction of 0.852 deaths per 1000 households, or at NZD 440 per year per treated household by valuing life years gained using a figure of NZD 150,000 for the value of a life year. This equates to ~ GBP 179, using a figure of ~ GBP 67,000.
- No impact on mortality after hospitalisation with respiratory conditions was identified. However, small but statistically significant lower hospitalisation costs for both respiratory and circulatory conditions were incurred.
- Researchers found an annual overall benefit per household of NZD 563 (~ GBP 251) for retrofitted insulation and only NZD 4.64 (~ GBP 2.1) for improved heating, with a higher figure for those receiving the scheme as low-income households. This was calculated by combining the change in total hospitalisations and total pharmaceuticals with reductions in mortality and benefits imputed from previous studies (including reduced frequency of GP visits, reduced days off work and reduced days off school).
- Cost-effectiveness analyses found a net benefit of NZD 0.95 billion (~ GBP 0.42 billion), using the estimated benefits for the programme of NZD 1.28 billion (~ GBP 0.57 billion) compared with an intervention cost of NZD 0.33 billion (~ GBP 0.15 billion). When health and energy results were combined with an analysis of industry impacts and employment changes, results of the cost benefit analysis were still highly favourable. The preferred scenario estimated that the programme will have a highly favourable benefit cost ratio of 3.9:1.

What are the conclusions, strengths and limitations?

- Retrofitted insulation delivered through the Warm Up New Zealand: Heat Smart Programme had a significant impact on reducing hospitalisation and pharmaceutical costs for occupants of houses that had been remediated compared to those living in matched houses in the area, who had not received insulation or heating as part of the Programme.
- This study is observational, rather than experimental, and this leads to the possibility for confounding where the self-selecting treatment group differs systematically from the matched control group. This issue could be potentially biasing the results, either upwards or downwards.
- It is important to note that these benefits do not include any improvements in comfort, which are separate from health-related benefits, and so these calculated benefits are conservative.

Gambling policy area

A total of four policies were identified in the field of gambling from five publications (196-200). None of the policies was directly aimed at improving health as a primary outcome, but they possibly had an impact on health indirectly. These indirectly targeted gambling frequency and gambling expenditure as key risk factors, mostly through restrictions on bets, note input (for example by reconfiguring note acceptors to allow only bets of smaller monetary value) and maximum wins, and reductions in reel speed. These all act to set a maximum limit on the price of each instance of gambling, thereby modifying the price per “unit” of gambling. One publication assessed the possible impact of redistribution of gambling revenue to fund public health services and improve community health status in a county in Mississippi, USA and so was included despite not directly representing a fiscal or pricing policy.

Three identified interventions were introduced in Australia at the local-level (ie clubs and hotels in the metropolitan and rural areas of New South Wales) in 2000 and at a regional level (ie Tasmania) in 2008. In Europe, one policy was introduced at a national level in Norway in 2006. It remains unclear whether these policies had any measurable impacts on health, but overall, the policies focused on minimising bet size and gambling expenditure did result in reduced overall betting behaviours and the overall value of the bets during betting.

Despite the rapid growth of the gambling industry across the world, only a few countries have studied the impact of any pricing measures to promote a reduction in gambling on health impacts of gamblers. Gambling has been linked to declines in mental health and well-being, in particular in young people, (201-203) so there is a real need for more evaluation of policies to curb gambling behaviour in a range of populations.

All identified policies were introduced in the 2000s, with a focus on the physical features of electronic gambling machines. Given the market trend to shift towards online betting systems in the past decade, any of the mentioned physical interventions may not be sufficient to target the growing number of online gamblers. However, there might be some lessons that could be learnt and incorporated into an online regulatory framework. Overall, studies exploring possible regulations of online betting places are required to identify meaningful interventions that could be adopted more widely.

Case study

Limiting cash flow on slot machines – Norway

Hansen and Rossow (2010) (200)

What was the policy objective?

- Research has pointed at the addictive nature of gambling on slot machines which may be linked to the rapid event frequency, short period between stake and pay out or loss, reinforcing sounds and colours, as well as the risk for loss of control over spending. However, the past decades have seen substantial rises in this form of gambling across the world, and in Norway slot machines were found to be the most dominant form of gambling in both adults and adolescents.
- From July 2006, all slot machines in Norway were modified by replacing bank note acceptors with coin slots. This led to a reduction in the highest betting stake from 25 EUR to 2.50 EUR.

What did the researchers do and find?

- Despite a minimum gambling age of 18 years in Norway, enforcement of age restrictions were found to be difficult. The aim of this study was to investigate the impact of a modification of slot machines on youth gambling, particularly to assess changes in gambling frequency, gambling expenditures and problem gambling in adolescents.
- The authors used data from the Norwegian school survey with a representative sample size of 20,703 students in 2004 and 21,295 in 2005 (pre-intervention), and 20,695 in 2006 (post-intervention).
- The policy intervention led to a significant 26% reduction in weekly gambling frequency amongst adolescents, and the overall gambling frequency was reduced by 10%. In the post-policy period, participants were 27% less likely to have gambled more than 63 EUR on slot machines the following week. Moreover, the proportion of problem gamblers as measured using a questionnaire was reduced by 20% as a result of the policy when controlling for person-level confounders.

What are the conclusions, strengths and limitations?

- The modification of slot machines that led to the removal of note acceptors was associated with significant decreases in gambling frequency, gambling expenditure, and problem gambling amongst adolescents. Previous research has shown that coinless machines can speed up gambling games by 15%, with the removal of notes acceptors facilitating a break up of sessions, which might reduce the likelihood of rapid and continuous gambling. Breaks might also help the gambler to reconsider whether any gambling activity should be continued.
- There are several limitations to this study. The authors investigated a short follow-up period, which may not be sufficiently long enough to assess the full impact of any policy implementation. Any observed changes were believed to be associated with the change in slot machines; however, it is possible that other secular trends, such as a change in social norms, contributed to the reduction in gambling frequency and problem gambling. The key strength of this study is the relatively large sample size and high response rate amongst students.

Healthy workplace policy area

A total of 24 policies/studies were identified in the field of healthy workplace from 27 sources (15-23, 109-111, 120, 124, 126, 135, 136, 141, 204-212), with five overlapping with the physical activity policy area (110, 111, 120, 124, 126, 135, 136, 141), two overlapping with the policy area of secondary prevention (210, 212) and 9 overlapping with diet and obesity (15-19, 21-23). All were forms of financial incentives to promote health-improving behaviour, for example, an initiative aimed at increasing activity through increasing steps taken in a working day amongst employees, or subsidising healthy food from the office canteen. This included direct financial incentives (16/24) and subsidies in the form of tax credits (8/24). The majority of identified interventions aimed at increasing a range of health behaviours, with the most frequent being increasing levels of physical activity, followed by incentivising a healthier diet, which includes increasing the consumption of foods such as fruit and vegetables. While most interventions targeted the general workforce population, some policies were directed towards specific risk groups, for example workers suffering from diabetes (2/24), smokers (2/24), or those classified as being obese (2/24).

The majority of identified interventions were policies and programmes implemented within workplaces and assessed using RCTs or observational studies, while one source modelled potential policies. Most interventions took place in English speaking countries, such as the United States (17/24) with two each in the UK and Korea and one each for Australia, Singapore and Sweden.

Twenty-two studies reported direct impacts on indicators of workers' health, whereas two studies introduced policies that are associated with indirect improvements in health. This included enrolment in health risk assessments, and increased health insurance coverage. The majority of studies found significant results, leading to improvements in workers' health, such as reductions in weight, smoking cessation, healthier eating by opting for foods with greater nutritional value (as defined in the papers included) at the workplace cafeteria, and higher levels of physical activity, for example through using the staircase more often.

Because most interventions were introduced at a small-scale in a company setting and with voluntary participation, there is little information to infer scalability, acceptability, costs or potential revenues if rolled out at a national level. Moreover, little is known about the long-term impact of these interventions, particularly in the absence of financial incentives once the policy has terminated. In most included interventions, authors evaluated policy effects over a short follow-up period (often less than one year). Because most interventions were implemented in a company setting, with the overall objective to improve workers health to lower rates of absenteeism and increase productivity, it remains questionable to what extent governments could adopt any of the incentives to derive the same benefits for the general workforce. Finally, most interventions relied on voluntary participation, and it is unclear whether compulsory enrolment into health improvement schemes would yield similar effects.

Case study

Financial incentive for achieving target weight in obese workers – USA

Kullgren et al. (2013) (18)

What was the policy objective?

- People suffering from obesity are more likely to die prematurely, often suffer from multi-morbidity, are costly for employers because of productivity losses and to the taxpayer, or insurers due to higher health care costs.
- Previous research has shown that financial incentives can lead to short-term reductions in weight, however little was known about the impact of financial incentives within a group, a setting commonly found in the workplace.

What did the researchers do and find?

- Researchers recruited 105 employees based at the Children's Hospital of Philadelphia, all with a BMI in the range of 30 to 40. The target aim of the intervention was to lose 24 pounds over a 24-week intervention period.
- A randomized controlled trial was used to assess the impact of financial incentives for two groups:
 - a) individual arm, where employees receiving USD100 for achieving a monthly weight loss target, and
 - b) group-based, where employees receiving USD100 for achieving their monthly weight loss target, but with an additional cash prize at the end of the 4-month period if all assigned group members reached a weight below the target.
- The researchers found that participants who were part of the group-based intervention arm lost significantly more weight over the observation period compared with participants who were allocated to the individual arm. Moreover, group-based weight loss was sustained for longer, with the mean reported weight loss of 6.5 pounds at twelve weeks after the financial incentive ended.

What are the conclusions, strengths and limitations?

- Using financial incentives in combination with peer-pressure can lead to a significant reduction in weight for people classified as obese. This mechanism is particularly important since many large companies were found to operate some incentive scheme to reduce weight in the workforce, but mostly aimed at the individual level. Harnessing social structures in the workplace can help reduce costs associated with introducing financial incentives by introducing lower incentives that have similar benefits to incentives in individuals alone.
- The study had a short follow-up period to assess the long-term sustainability of the achieved weight loss. The motivation to achieve large weight loss goals may not have been sustainable over a longer intervention period.

Secondary prevention policy area

A total of 18 policies/studies were identified in the field of secondary prevention from 27 publications (18, 57, 109, 125, 145, 207, 210, 213-232). Two of these overlapped with the field of healthy workplace policies ((210, 212). Sixteen were forms of financial incentives to promote uptake of secondary prevention activities, in the form of cash transfers while two were direct subsidies. The target secondary prevention activities varied across policies and studies, but can broadly be categorised into promotion of health screens for a range of diseases, such as cardiovascular disease, diabetes, colorectal cancer and sexual health (10/18), promotion of uptake of immunisation (2/18), and six related to the promotion of healthy activities such as physical activity, diabetes control, multiple disease prevention(eg for CVD and diabetes and kidney disease at the same time), prenatal care and smoking cessation.

The majority of the studies were either observational or RCTs studies assessing existing programmes and policies (17/18). The setting for these policies or studies were mainly in English speaking countries with 10 in the USA/Canada, 4 in Australia, 3 in the UK and 1 in Mexico.

Only one policy of prenatal subsidies in Canada reported direct impacts on health (see **Case study**), while the rest reported intermediary outcomes on the pathway to health. The majority of these policies and studies incentivising secondary prevention activities found significant results, although two studies incentivising colorectal cancer screening through either Faecal Immunochemical Test or Faecal Occult Blood testing did not show a significant impact in uptake of testing.

As the majority of the sources on incentives for secondary prevention activities were small-scale randomised trials, there is little information available on the scalability, acceptability, costs or potential revenues of implementing such schemes at a national level. Policies that have been implemented and evaluated have shown health impacts and impacts on intermediate health outcomes, but these effects remain small, with little information on long-term changes. Further research would need to be undertaken to consider how these interventions can be developed to regional or even national level, and more in depth analysis of the equity considerations for such policies would be needed, as well as more consideration of long-term effects.

Case study

Incentive for perinatal health outcomes – the Health Baby Prenatal Benefit– Canada

Brownell et al. (2016)(225)

Brownell et al. (2015) (226)

What was the policy objective?

- Perinatal outcomes are known to influence health status of children throughout their life course, women living in poverty are more likely to be exposed to high levels of stress, have inadequate nutritional intake and smoke and/or drink during pregnancy and are more likely to give birth to preterm or low or high birth weight infants.
- Through universal healthcare in Canada, prenatal care is already provided free of cost, but the Canadian province of Manitoba introduced the Health Baby Prenatal Benefit (HBPB) to improve prenatal health and birth outcomes for women in their second and third trimester of pregnancy on very low income (annual income below CAD 32,000 , equivalent to GBP 17,557)
- HBPB prenatal income support of up to CAD81 (GBP45) per month to eligible pregnant women (representing an almost 10% increase in monthly income) to be used with no conditional requirement.

What did the researchers do and find?

- Using a range of regional population, health and medical databases for 2003 to 2010, they compared multiple birth and early life outcomes between mother-infant pairs who received the HBPB and a comparison group of comparable pregnant women receiving welfare.
- Receipt of the HBPB resulted in higher rates of breastfeeding initiation (6%), a decreased length of stay in hospital after uncomplicated vaginal birth, lower odds of a low birth weight, pre-term, small for gestational age and greater odds of a large for gestational baby (13%), and up to 20% greater odds of complete immunisation records for the child at two years old.

What are the conclusions, strengths and limitations?

- Imposing conditions on incentives such as income supplements may not be necessary to achieve a number of positive prenatal and perinatal health outcomes

- This study used administrative databases, which provided rarely available risk factor data, and avoids the problem of reporting and bias in participant's recall.
- Comparability of income between exposed and unexposed may not have ensured total comparability of the population, and only limits conclusions to very-low income women.
- It was not possible to determine why the HBPB made the difference. Further research is needed to ascertain if this was through reduced stress, through on time payment of rent, or better nutrition, for instance.

Targeted searches for tobacco and alcohol policies

Tobacco

The use of taxation on tobacco to promote reduction in consumption is long standing and has been implemented by many governments, in a range of countries globally (233). The body of evidence on such policies for tobacco and reviews of the effectiveness of this strategy is large (5, 10, 234). Reviews conclude that traditional taxes on tobacco products represent one of the most effective means of tobacco control (235), and these conclusions still hold. It was therefore not necessary to review the whole body of literature on these overall fiscal policies for tobacco control. Instead, the focus was on collecting evidence to answer targeted questions of interest. Evidence was included if published after 2010, the date of collection of data for the International Agency for Research on Cancer review (235).

The specific fiscal and pricing policy areas of interest in the field of tobacco were:

1. Taxation of e-cigarettes (with a focus on VAT reduction as an incentive to switch)
2. Minimum unit pricing for cigarettes/packs
3. Incentives to promote smoking cessation in pregnancy/in low socio-economic populations
4. Hypothecation of a tobacco industry levy for smoking cessation activities (special focus on this policy in France and USA)

Findings from the individual reviews are described below:

1 Taxation of e-cigarettes (with a focus on VAT reduction as an incentive to switch)

The revised European Union Tobacco Products Directive is now fully operational in England, transposed into UK law through the UK Tobacco and Related Products

Regulations 2016, and covers e-cigarettes and nicotine-containing e-liquids that do not have a medicinal licence. Alongside products regulated in line with the EU Tobacco Products Directive, manufacturers can also apply for medicinal licensing from the Medicines and Healthcare products Regulatory Agency. However, no licensed e-cigarette has yet been marketed. No study or report on the impact of e-cigarette taxation on health or health related outcomes was identified. It may be too early for estimates, but any study on this should be included in the framework as the evidence emerges over time.

2 Minimum unit pricing for cigarettes/packs

One USA study (236) was included which examined the impact of three federal level minimum cigarette pack prices on sales and numbers of smokers, and estimated that a USD 10 minimum pack price would result in 5.7 billion fewer packs being bought per year nationally, corresponding to an approximate 41.0% reduction in sales and 10.7 million fewer smokers due to cessation .

3 Incentives to promote smoking cessation in pregnancy/in low socio-economic populations

Several studies and systematic reviews assessed the impact of financial incentives to promote smoking cessation in pregnant women, and these were mainly RCTs comparing usual care to vouchers or cash contingent on the rate of pregnant women quitting smoking and remaining a non-smoker which was assessed biochemically in most studies (237-248). These studies found mixed evidence of effectiveness, and effects appeared to wane over time, which is common to all stop-smoking interventions. Two reports were included on a trial and a scheme implemented since the Cochrane review (238) in the North of England, which have shown a significant impact in quit rate. The size of the incentive in these England-based interventions was similar to that offered in the trials included in the aforementioned Cochrane Review, which overall reported significant effects on abstinence: in a single arm intervention study which in Derbyshire provided vouchers worth GBP8 to GBP 32 over up to 32 visits pre and postpartum, contingent on smoking abstinence assessed by monoxide testing, 60% of 239 participants enrolled in a scheme attempted quitting during pregnancy, with 20% being confirmed quitters at delivery and 10% 6 months post-partum (240). In a scheme

rolled out and assessed during 2012-2013 in the North of England, quasi-financial incentives in the form of vouchers that could be spent at a range of high street shops were used as an incentive. Each woman was eligible to receive a maximum of £260 worth of vouchers - if she was recruited in the early weeks of pregnancy and remained smoke free at the 12-week post-partum point. Out of the 403 women recruited to the scheme 69% set a quit date and achieved a four-week quit, 71% (n=200) of those went on to be still quit at time of delivery, and 51% (n=142) were still not smoking at 12 weeks post-partum. This scheme has been extended to other regions of the UK since. For a more in-depth description of one of these intervention trials in Scotland, see the **Case Study** below.

4 Hypothecation of a tobacco industry levy for smoking cessation activities (special focus on this policy in France and USA).

In 2017, France passed legislation to levy a 5.6% tax on producers and suppliers of tobacco. By taxing suppliers, the government targets the largest supplier of tobacco in France – Logista that accounts for 98% of sales revenue from tobacco product. The government anticipates that Logista will pass this new charge on to the big tobacco companies whose products they distribute. A key feature of this new tax is that all the money will be devoted to government anti-tobacco initiatives. The government agency normally responsible for tobacco control in France is the Health Department. However, because the new tax measure was included in the law that governs universal health insurance, the new tobacco control funds will be administered by a national health insurance agency, which is used to administering health insurance claims, but has little experience in tobacco control. Tobacco industry estimates that this new tax will increase a 20 pack of cigarettes by 15 cents to EUR6.50; and will increase the price of a 30g pack of rolling tobacco by 15 cents to EUR 7.40; and increase a pack of 20 cigarillos by 35 cents to EUR 7 (249-255).

No information was identified on the impact of recent earmarking policies of a tobacco industry levy implemented in some states in the USA towards tobacco cessation activities. It may be too early for any health impact to be evaluated for these policies.

Case study

Incentive for smoking cessation in pregnancy – the Cessation in Pregnancy Incentives – Scotland

Tappin DM et al. (2012) (247)

Tappin DM et al. (2015). (246)

Tappin DM et al. (2014). (245)

Boyd KA et al. (2016) (237)

McConnachie A et al. (2017)(242)

What was the policy objective?

- Smoking during pregnancy kills 4000 babies annually and costs an extra GBP20-90 million for pregnancy and infant care in the UK. Only 5-10% of pregnant smokers quit when offered current interventions. The short-term cost of delivering a complicated birth, the care of a low birth weight baby or the care of a premature baby is estimated at GBP 12,000 per child.
- In Scotland, 70% of women have at least one baby, making pregnancy an opportunity to help most women quit before their health is permanently compromised. In 2009, 24% of women in Scotland attending their first antenatal appointment self-reported being smokers. However, only 1 in 10 used evidence-based NHS cessation services, with 3% reporting abstinence at four weeks after quitting.
- This study investigated the impact of quasi-financial incentives on smoking cessation rates in pregnant women.

What did the researchers do and find?

- This study was a phase 2, single-centre, single-blinded, parallel group individually randomised controlled superiority trial with qualitative and health economic components. The participants were self-reported pregnant smokers referred to Stop Smoking Services. Women in both groups were offered routine care, with women in the intervention group offered GBP50 in Love2Shop vouchers for attending a face-to-face appointment and setting a quit date, GBP50 if confirmed smoking cessation after 4 weeks from quit date (carbon monoxide testing), GBP100 after 12 weeks, and GBP200 in late pregnancy (34-38 weeks). The cost-benefit analysis used routine and trial derived data.
- Significantly, more smokers who were offered the incentives had quit after 12 weeks compared to the controls: 22.5% versus 8.6%. There were no harms reported and incentives were acceptable to clients and health workers.
- The mean birth weight was 3140g (SD 600g) in the incentives group and 3120g (SD 590g) in the control group. There was a clinically significant estimated increase in birth weight of 145g amongst those who stopped smoking as a result of the intervention.
- Financial incentives for smoking cessation in pregnancy are highly cost-effective. Short-term incremental cost per quitter was GBP1127 and longer-term cost per QALY was GBP482.

What are the conclusions, strengths and limitations?

- This trial provides substantial evidence for the efficacy of incentives for smoking cessation in pregnancy. The findings can serve as the basis for future research to include other UK centres and other healthcare systems.
- This study provides substantial evidence on the cost-effectiveness of a financial incentives intervention to add to existing cessation support. The incremental cost-effectiveness ratio of GBP482/QALY is well below the recommended threshold.
- The key strengths of this study are the RCT design and cost-effectiveness analysis. It uses outcome data from the RCT for the cost-effectiveness analysis. This is the first cost-effectiveness analysis of financial incentives for pregnant smokers. While incentives for health behaviour change remain controversial, the qualitative data found that incentives were acceptable to women and healthcare professionals.
- The key limitation is the exploratory nature of the trial, limited to one geographical location in Glasgow.
- A future definitive trial is needed in more than one centre to confirm efficacy, cost-effectiveness, and generalisability. A future study needs to consider geographical location and type of smoking cessation service. Furthermore, future studies should more closely examine outcomes in the postnatal period: For these reasons, a Phase 3 trial (2017-2020) is currently extending the findings of this trial (<http://www.isrctn.com/ISRCTN15236311>)

Alcohol

Fiscal and pricing policies to promote the reduction of alcohol consumption are used extensively in several countries (256). These have been studied and reviewed extensively(9, 257), including in a large review prepared by PHE (4). The evidence reviewed consistently indicates positive health outcomes, at the population level, from taxation of alcoholic beverages. The 2016 PHE review (4), also considers the use of pricing policies such as MUP to discourage the harmful consumption of alcohol. The empirical evidence and modelling studies included showed that setting a minimum price for alcohol can reduce alcohol-related harm while saving health care costs.

Much like for tobacco, there was therefore limited interest in reviewing the full body of evidence on fiscal and pricing policies as this is already summarised in the PHE evidence review. Instead, we consulted with PHE to identify areas and questions to be considered in the context of this review.

The specific fiscal and pricing policy areas of interest in the field of alcohol were:

1. Fiscal and pricing policies to promote consumption of lower-strength alcohol (ie volumetric taxation)

2. Evidence of alcohol duty policy implemented, not modelled outside of the EU
3. Experience of minimum unit pricing outside the UK. (While the other publications followed the general review inclusion criteria, the evidence of health impacts of minimum unit pricing policies outside of the UK were limited to publications after 2016. This is due to the publication of the PHE evidence review in 2016.

Findings from the individual reviews are described below:

1 Fiscal and pricing policies to promote consumption of lower-strength alcohol (ie volumetric taxation)

Out of seven publications identified (258-264), 16 different models of volumetric taxation were included in the framework. The majority of publications focused on modelling the impact of different volumetric taxation schemes in Australia (see the **Case study** section for more details on these modelled scenarios), and one study modelled the potential for volumetric alcohol taxation in the UK (264). Outcomes reported in these modelling studies included deaths avoided and DALYs gained. Conclusions based on these publications are limited by the inherent limitations of modelling studies, but nevertheless offer consistent evidence of a positive impact on health of volumetric taxation of alcohol. For example, the UK study identified that a volumetric taxation that could match the estimated impact of a £0.50 minimum unit price policy currently implemented in parts of the UK would mean replacing the current excise duty with a duty of £0.22 per unit for all beverage types on top of the current system of excise duty and value added tax (VAT) in England with no change to any taxes in the rest of the supply chain, either at the production or wholesale stages, would result in a 4.3% reduction in number of deaths per year in the total drinking population compared to baseline, corresponding to 530 fewer deaths per year (264).

2 Evidence of alcohol duty policy implemented, not modelled outside of the EU

There was no information found on health impact assessments of alcohol duty policies implemented in countries outside the EU. This might be because of a lack of focus on assessing existing policies, with more focus in the literature on modelling modifications to existing or new policies.

3 *Experience of minimum unit pricing outside the UK (after 2016)*

The evidence on minimum unit pricing policies reviewed was limited to evidence from 2016 onwards, and from outside of the UK. This was to both avoid duplication with the PHE 2016 report on the topic and avoid repeating information on MUP studies in the UK, which have been discussed at length and in part contributed to the implementation of £0.50 MUP in Scotland.

The PHE reviewed empirical and modelling studies of MUP, and concludes, “empirical evidence and modelling studies have shown that setting a minimum price for alcohol can reduce alcohol-related harm while saving health-care costs”.⁽⁴⁾ We considered additional evidence from 2016 onwards, outside the UK, and identified two publications which added to the outcomes of policies included in the PHE review.

One publication was an assessment of the impact of MUP in Saskatchewan on acute hospital admissions (265). The Canadian province of Saskatchewan implemented a set of minimum prices across multiple beverage categories in 2010, and these price limits were made partially ‘alcohol volumetric’, applying both to sales in liquor stores and to prices paid by owners of bars and restaurants. In the latest 2017 publication on this policy, there was an observed 40% reduction in motor vehicle collision-related emergency department visits for women aged 26 and over only, six months after the policy intervention. However, no impact on other age groups or men was detected.

The other publication was a 2016 modelling exercise considering a mandatory MUP of AUD\$1.00 per standard drink measure in Australia (258). This report was based on previous work on MUP (266) (included in the PHE review), but this recent report included in the framework presents findings on the regressivity of such a policy in Australia. A MUP was found to be largely regressive, with overall spending of beer, wine and spirits combined representing 2.7% of income for lowest income quintile consumers, compared to 0.3% in the highest quintile consumers. This distributional impact however, translates into 11.5 fewer standard drinks consumed per week in the lowest-income wine consumers, compared to only 2.5 fewer standard drinks per week less in highest income wine consumers. The predicted impact on consumption of beer was not as different across income quintiles (5.7 standard drinks for lowest and 5.4 standard drinks lower in the highest income group).

Case study

Volumetric taxation of alcohol – Modelling and comparison of several different designs – Australia

Doran et al. (2013) (263)

Victorian Health Promotion Foundation. (2011) (262)

Byrnes et al. (2010) (260)

Byrnes et al. (2012) (261)

Sharma et al. (2014) (266)

What was the policy objective?

- Evidence suggests that alcohol taxation, as a means of increasing the price of alcohol, is one of the most effective policy interventions to reduce the level of alcohol consumption and related problems, including mortality, crime and traffic accidents.
- In Australia, volumetric excise taxes (that is, taxation based on how much alcohol a product contains) are levied on beer and spirits based on pure alcohol content and an ad valorem excise tax (that is, a tax depending on the product's value) is levied on wine based on the wholesale price. With this system, there exists a large divide regarding the amount of tax charged for the equivalent amount of pure alcohol consumed.

What did the researchers do and find?

- Two studies used mathematical economic and epidemiological modelling of three or four scenarios of volumetric alcohol taxation for their potential impact on the Australian population. Examples of these scenarios include no change in deadweight loss – that is no reduction in the economic efficiency and production of the tax; no change in revenue; applying an equal tax rate to all beverages; and applying an excise tax rate that increases exponentially by 3% for every 1% increase in alcohol content above 3.2%. The outcome measures for these studies were changes in alcohol consumption, tax revenue and health benefit (DALYs).
- All volumetric tax scenarios would provide greater health benefits and cost savings to the health sector than the existing tax system. This is based on current understandings of alcohol-related health effects.
- One study used a partial equilibrium approach to quantify the effect of four different alcohol taxation systems relative to the current Australian system: two different types of volumetric taxation; increasing the tax only on ready-to-drink alcoholic beverages; and a tiered tax system. Estimates of taxation revenue, consumer welfare and consumption measures were used.
- Increasing tax solely on ready-to-drink alcoholic beverages increased taxation revenue by AUD 479 million (~ GBP 266 million) and reduced pure alcohol consumption by 754 000 litres. For a tax neutral approach, a volumetric tax could substantially reduce the cost of taxation by AUD 177 million (~ GBP 84 million) and reduce pure alcohol consumption by 468 000 litres.
- One study used Nielson scanner data from a panel survey of demographically representative households over a one-year period in the state of Victoria, Australia to compare the potential

impact of minimum unit pricing (MUP) versus volumetric taxation. This data includes detailed records of each household's off-trade alcohol purchasing.

- Both MUP and uniform volumetric tax have little effect on changing the annual cost of wine and beer for light and moderate consumers, and little effect upon their purchasing. Applying a MUP of AUD 1 per standard drink (~ GBP 0.5) has a greater effect on reducing the mean annual volume of alcohol purchased by the heaviest consumers of wine and beer, compared to a uniform volumetric tax.

What are the conclusions, strengths and limitations?

- The findings of the modelling studies suggest that any proposed variations to current rates of alcohol excise would be a cost-effective health care intervention. However, an equalised volumetric tax that would reduce beer and wine consumption while increasing the consumption of spirits would need to be approached with caution. These studies reinforce the evidence that taxation is a cost-effective strategy.
- These studies allowed for the comparison of various volumetric alcohol taxation scenarios for their potential impact. The estimates of price elasticity rely on United Kingdom data and there may be variations in Australian consumers' responsiveness to price changes; long-term risky drinkers may be more (or less) price-sensitive than short-term risky drinkers. Modelling also assumes an immediate reversal of risk for alcohol-related cancers and other health harms. These studies did not assess other significant costs averted from a reduction in alcohol consumption, such as crime.
- The partial equilibrium approach found that for the same tax revenue, consumer welfare can be reduced or, for the same level of loss to consumer welfare, taxation can be increased. Both scenarios result in a reduction of pure alcohol consumption.
- Limitations to this study include for example: the price quantity data relied on was based on aggregated national sales data for 1 year and short-term price discounting was not applied; the analysis assumed that beverage types have no impact upon drinking behaviour; and no direct attention has been given to the distinction between alcoholic beverages consumed at home, as opposed to licensed venues.
- Both MUP and a uniform volumetric tax have the potential to reduce heavy consumption of wine and beer without adversely affecting light and moderate consumers. MUP offers the potential to achieve greater reductions in heavy consumption at a lower overall annual cost to consumers than a volumetric tax.
- An advantage to this study is that it compares the estimated effects of a MUP and a volumetric tax according to different levels of consumption, and uses highly detailed electronically scanned records of household-level alcohol expenditure for this analysis. Limitations to this study are the lack of matched records for households' drinking patterns with alcohol purchases; the lack of records for on-trade purchases; and not accounting for possible substitutions between products.

Discussion

As evidence has emerged of links between certain types of consumption and adverse health outcomes, particularly in connection with chronic non-communicable diseases, curbing those types of consumption by making them less affordable has become an increasingly important goal of public health policies.

Public health has found key allies in finance ministries and tax policy makers especially, but not exclusively, in areas in which products that can harm human health also have important negative impacts on people who do not directly consume those products (externalities). These products are typically viewed as primary candidates for taxation, particularly excise taxation, as a way to make consumers pay for the social costs generated by their consumption. The case for taxation is also strong when the demand for the products concerned is not very responsive to price hikes (inelastic demand), which means that significant revenues can be raised by taxing those products. Therefore, products like alcoholic beverages and manufactured tobacco products have been taxed in many jurisdictions long before the public health community started viewing taxation as an integral component of its policy toolkit.

Once it has been established that altering market prices through taxation can change consumption behaviours and generate beneficial health outcomes, public health has progressively expanded its focus on price measures as a way to deter harmful consumption. This has included broadening the scope of excise taxation to areas not traditionally considered by tax policy makers (sugar-sweetened beverages being the most prominent example), considering the use of other indirect taxes (eg VAT) to modulate the prices of healthier and less healthy products, and also promoting administrative price regulation measures. While the latter are not fiscal measures and do not involve the collection (or expenditure) of financial revenues by governments, they have been viewed in some cases as more flexible price incentives that can be better targeted to the least healthy types of consumption. Minimum alcohol prices are an important example of price regulation aimed at curbing the most harmful types of alcohol consumption.

Increasingly, public health policy makers have also been exploring opportunities to use the price lever to incentivise forms of consumption that are conducive to beneficial health outcomes, both through fiscal (eg product subsidies) and regulatory price measures.

The evidence base on the impacts, including health impacts, of alcohol and tobacco taxes is extensive, and a significant body of evidence is also building up on sugar-sweetened beverage taxes. Less is known about the health impacts, actual or potential, of fiscal and price measures in other areas, including in areas in which the use of fiscal policies is well established, such as the reduction of polluting emissions, probably because the focus on the health outcomes of fiscal and price policies is a relatively recent one. Nevertheless, evaluating health outcomes is also difficult, because in many cases these emerge only with a significant delay relative to the point of purchase and consumption of the products concerned. This may be due in part to NCDs taking many years to manifest themselves and also that they are multifactorial and do not just rely on the consumption of different commodities or substances. Health outcomes are also difficult to identify because many studies are either short term and/or are modelling studies; therefore assessing the precise magnitude and causal nature of the effect of price changes on those remote health outcomes involves important methodological challenges.

This report presents a review of the evidence available to date on the health impacts of fiscal and price policies across, as well as within, a range of policy areas. The review, designed primarily as a scoping exercise, aimed at mapping areas in which the evidence base is more robust and areas in which it is weaker or lacking. While there is a large body of literature on many policies, improved health is often not the main aim of the policies, while revenue raising or targeting proxy health outcomes can be the main focus. However, a few areas have been assessed explicitly for an impact on health or health-related behaviours/proxy outcomes. The work was undertaken within a tight timeframe and resource constraints, therefore a number of exclusions were made in the scope of the review, as discussed in the previous sections. While the approach was systematic, this review should not be considered comprehensive, and serves to illustrate but not quantify the existing evidence. In addition, significant effort was put into

developing an extensive and useful framework, but the information captured within it may be incomplete and certain elements of policy analysis, including collecting information on context, which is not readily available in most scientific reports, may be missing.

The results presented in this report must be read as complementary to those of existing reviews and compendia of fiscal and price policies, such as:

- Public Health England. Sugar reduction: from evidence into action, Annexe 2: A mixed method review of behaviour changes resulting from experimental studies that examine the effect of fiscal measures targeted at high sugar food and non-alcoholic drink London: 2015.(7)
- Public Health England. The Public Health Burden of Alcohol and the Effectiveness and Cost-Effectiveness of Alcohol Control Policies. An evidence review. 2016. (4)
- World Health Organization. Promoting Health, Preventing Disease The Economic Case: The Economic Case: OECD Publishing; 2015. (267)
- OECD Database on Policy Instruments for the Environment: <https://pinedatabase.oecd.org/>
- Global database on the Implementation of Nutrition Action (GINA): <http://www.who.int/nutrition/gina/en/>
- WRCF NOURISHING policy framework: <https://www.wcrf.org/int/policy/nourishing-database>

This review provides some important indications on areas in which the use of fiscal and price policies could potentially be expanded in order to improve health outcomes in England. However, these indications are only preliminary and more analysis is required to determine whether the evidence of health impacts generated by the studies reviewed in this report is representative of the impacts that similar policies would achieve if applied on a large scale in England.

Summary of findings

As would be expected, where harm is largely due to overconsumption of an unhealthy commodity (eg tobacco, alcohol and a less healthy diet), fiscal strategies were used as disincentives for consumption through taxation and in a few cases included price increases or regulations that would result in price increases. For example cap and trade for sugar where the food industry has a cap on the amount of sugar it can produce, similar to emissions trading environment policies, and minimum pack price for smoking.

Fiscal and pricing policies to improve public health

In other policy areas, the focus was largely on subsidies and incentives to promote the uptake of healthier behaviours (physical activity, healthy workplaces, and secondary prevention) or exposure to healthier environments such as for the environment or housing policy areas.

The majority of fiscal and pricing policies were identified in the diet and obesity field, although most of the papers included are modelling studies rather than intervention studies, while evidence for the public health impact of policies for gambling, housing and the environment was limited, and often based on smaller scale studies of local-level evidence. There were a number of policies identified focussing on the impact of financial subsidies and incentives to promote physical activity, healthy behaviours within the workplace as well as the uptake of secondary prevention activities.

The overlap between both fiscal and pricing strategies and target behaviours across policy fields clearly outlines opportunities for cross learning across different areas, and even the potential for combining incentives for multiple health behaviours. For instance, the role of subsidies to influence healthy diets was examined both in the general population and in a more targeted environment such as the workplace. Similarly, environmental policies which aim to reduce travel by car to reduce emission, may promote active travel, and such policies may therefore provide a 'double win'.

Less than a third of intervention studies reported health impacts for the policies examined, including numbers of disease cases or deaths avoided, quality-adjusted life years, disability-adjusted life years (66/234). The remainder only reported on intermediate outcomes, which were on the pathway to health, such as consumption of certain products or reduction of certain behaviours.

The majority of direct health impacts were reported in the field of diet and obesity, mainly through the use of modelling, so these impacts remain theoretical. Other fields which reported health impacts include housing and alcohol, with far fewer studies in the environment and physical activity fields reporting these. In contrast, only one or two studies from the fields of gambling, healthy workplaces, secondary prevention activities and tobacco provided any direct health impacts, instead focussing on outcomes such as

changes in physical activity levels, dietary intake, smoking rates, or other proximal outcomes. In the case of the gambling literature, the outcomes were indeed very distally related to health, as no impacts on mental health were reported, and instead the only impacts recorded were changes to betting behaviour and value and frequency of gambling, making it very difficult to draw any strong conclusions in this field.

The majority (39/66) of intervention studies/policies which reported a health impact consisted of taxation, with 15 being subsidies, while only a few considered joint taxation and subsidies, or financial incentives. Almost all analyses of financial incentives reported proxy outcomes. It should be noted that when a health impact was reported, it was almost always (53/66) a significant, positive impact on health.

In summary, the policies that provided a strong indication of a direct impact on health were mainly taxation policies in the field of diet and obesity or alcohol, or subsidies for housing. However, the vast majority of the health impacts reported came from modelling studies. This is likely because health impacts take time to manifest, and modelling studies consider longer timeframes, but also integrate the impact on health of observed changes in behaviour as a result of policies. However, robust modelling studies, of which there were many, are useful to add to the case for taxation policies.

Inequalities

There is evidence that more established fiscal policies on commodities related to health have a distributional impact. For example, a USA state-wide tax on tobacco has been shown to impact behaviour, as the majority of smokers, and particularly low-SES smokers, report behavioural steps toward quitting or achieving sustained tobacco cessation in response to cigarette taxes⁽²⁶⁸⁾. Only a limited number of policies (21%) reported distributional effects and these could be financial or sometimes health inequalities. Over half found the policies investigated to be progressive (that is, the effect of the policy was more pronounced in lower socio-economic groups with regards to health or income); a third to be regressive and the rest either found no evidence of a distributional impact, or provided too little information to classify. There was no clear trend in the type of policies or the policy areas that showed either progressive or regressive impacts, however, whether policies are regressive depends on consumption

patterns and demand elasticities that vary across countries and products (269). Diet and obesity was strongly represented in both groups, but this is likely due to the higher volume of literature in this policy area. It should be noted that there might be a reporting bias effect in the publications collected, whereby studies that find a positive, progressive impact of policies are more likely to report this finding.

Conclusions

The findings of this review provide a number of indications about potential new ways and areas in which fiscal and pricing policies could be used as public health measures in England. This potential is largely dependent on the goals of public health policies to which fiscal and price policies are designed to contribute. These goals may range from health improvement (either in the population at large or in high-risk individuals), to revenue generation (if this can be at least partly directed to the financing of public health or health care measures), to the reduction of health inequalities. Some of the indications emerging from this work are discussed below in connection with the three policy goals listed above.

Health improvement

Key conditions for fiscal and price policies to generate further significant health impacts are as follows:

- the risks associated with harmful consumption behaviours should be significant and widespread;
- it should be possible to alter prices by a relatively large margin, or consumption should be very responsive to price changes (elastic demand);
- there should be significant scope for an expansion of existing fiscal and price policies or for introduction of new ones

Much of the evidence reviewed in this report shows fiscal and price policies do have the potential to improve health outcomes but, per se, they are not sufficient to reverse or contain major health risks. They need to be combined with the implementation of other policies with which they may act synergistically in curbing the relevant risks.

Diet is an area that offers major potential for health improvement, but the second condition above (that potential price changes should be quite large, or that the demand

should be elastic) can hardly be met in this area – eg because of the risk of regressive financial impacts – unless a mix of price-increasing and price-decreasing measures is adopted. Moreover, in order to maximise the impact on health, taxes should be designed so as to cover potentially unhealthy substitutes, identified through a detailed assessment of cross-price elasticities. Taxation can also provide an incentive for reformulation, especially when demand is more elastic, which could thus lead to overall reduced consumption of the unhealthy commodity. However, this latter impact would not be detected if focussing on purchases, as many publications in this report do.

The studies reviewed in this report provide evidence that both price increasing and price decreasing measures are effective in improving health, and using them in combination might lead to healthier diets and improvements in a range of long-term chronic disease outcomes. In fact, previous reviews have concluded that taxes on foods and non-alcoholic beverages work best when associated with subsidies on healthier options (49, 102, 177, 270). However, much of the latter evidence is based on simulations of the combined effects of individually assessed fiscal or pricing measures. Empirical analyses of existing policies that combine price-increasing and price-decreasing measures are lacking and the prospect of “engineering” healthier diets through comprehensive price incentives remains largely hypothetical at this stage. The use of fiscal approaches based on some form of nutrient profiling, that is the classification of various food and beverages depending on their nutritional composition for reasons related to preventing disease and promoting health, requires further significant consideration before any assessment was undertaken. We note that in Chapter 2 of the Childhood obesity: a plan for action document, the government may consider further use of the tax system to promote healthy food if the voluntary sugar reduction programme does not deliver sufficient progress (271).

This review also points to environmental policy as having potential for health improvement, although evaluations that account for the health benefits of emission reduction policies are still limited. However, exposures to polluting emissions are widespread, the health and health care impacts of such exposures are now well established, and there is at this moment significant scope and momentum for expanding measures to control emissions, including by making consumption behaviours that

generate pollution less affordable. The opportunity to combine environmental and health benefits (co-benefits), as well as the externalities involved, make the case for that expansion especially strong. Like with diet, a mix of price-increasing and price-decreasing measures can, and probably should, be adopted to maximise opportunities for health improvement. Existing studies provide evidence that both can be effective.

A third area in which this review shows potential for health improvement is healthy workplace measures. Through workplaces, especially larger ones, public health measures can reach very large numbers of people at an important stage in their life course, potentially modifying a number of exposures and behaviours that are key in determining the risk of leading chronic non-communicable diseases. The evidence available in this area tends to be from small-scale studies involving voluntary participation and relatively short-term outcomes, but the findings are consistently favourable, which suggests that there is scope for a more detailed and rigorous assessment of the health improvement potential of fiscal and price policies aimed at making workplaces healthier.

There are, of course, opportunities for meaningful further health impacts from fiscal and price policies in the areas of tobacco and alcohol consumption, although these two policy areas are quite mature and a major reform of existing policies may involve technical as well as political challenges, which means that changes tend to happen incrementally in these areas.

For instance, the affordability of alcohol has increased in the UK due to various tax freezes and duty escalator removals, and so alcohol taxation remains the most cost-effective intervention to reduce alcohol consumption and harm, as summarised in the PHE evidence review(4). Regulating the prices of alcohol products (eg as Scotland has done with the introduction of minimum unit pricing) has the potential to provide additional benefits over and above those so far achieved with taxation, with an improved targeting of the highest-risk alcohol consumption behaviours.

Price regulation of tobacco products has so far been prevented by EU legislation (272), but there is at least some (relatively crude) evidence that minimum prices would be effective in curbing tobacco smoking further, and this policy might become legally viable

once the UK leaves the EU. Similarly, further benefits may derive from an improved targeting of alcohol taxation to higher-risk drinkers. The evidence presented in this review is mainly in connection with volumetric taxation, and this provides encouraging results relative to the impacts of the current alcohol taxation system in the United Kingdom, which involves relatively high tax rates, but is less well targeted to heavy individual consumption, and may be legally viable once the UK leaves the EU. The findings of this review suggest that there is scope for a detailed assessment of the potential large-scale impacts of a volumetric taxation system, of the transferability of the evidence available from other countries, and of the implementation challenges involved in reforming the existing taxation system.

Revenue raising

Raising fiscal revenues is not a public health goal *per se*, of course, but it can become one if the revenues generated by a tax can be directed, wholly or in part, to the funding of public health or health care programmes. Public health advocates increasingly call for the hypothecation, or earmarking, of taxes raised on unhealthy consumption, but governments (finance ministries) typically use tax hypothecation sparingly, if at all. The introduction of a new tax, or a tax hike, can be combined with the announcement of new or increased public expenditures, but without a tight link between revenues and expenditures. In the United Kingdom, this has happened for instance during the second Blair government, when a major boost in NHS spending, designed to bring this in line with that of other EU countries, was purportedly funded by a 1% increase in National Insurance contributions introduced at the same time. A further example is the recently established Soft Drinks Industry Levy (sugar-sweetened beverage tax), whose revenues will be used to fund physical activity programmes in schools. These types of “soft” earmarking of tax revenues are more common and can prove very helpful in gaining public support for new fiscal measures, or justifying increased spending in certain areas. However, price regulation measures, and fiscal policies on the expenditure side (eg subsidies), clearly fall outside the scope of revenue raising policies.

Tax policies targeting specific forms of consumption can generate significant additional revenues when the following conditions occur:

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- the taxed products are widely consumed
- the prices of taxed products are high (for ad valorem taxes), or it is possible to set large ad quantum taxes
- the consumption of the taxed products is not very responsive to price changes (inelastic demand), or it is possible to limit opportunities for substitutions by consumers
- in addition, there should be significant scope for an expansion of existing fiscal and price policies or for the introduction of new ones (assuming that only soft earmarking is considered, as discussed above)

The taxation of alcohol and tobacco products meets many of the above conditions and is a major source of fiscal revenues in most countries. However, its revenue raising potential is already largely tapped into in England. While further increases are possible at the margin, it is unclear how tax hikes or even substantial reforms, would significantly increase the revenues raised by these forms of taxation. One estimate from the Office for Budget Responsibility puts the public costings of the cumulative loss to the Exchequer from the successive alcohol duty freezes and cuts from financial year 2013-14 to the current financial year 2018-19 to be around £4.0 billion (273).

A move towards volumetric alcohol taxation may be designed to increase revenues, as higher price products and less price-responsive consumers would be more heavily targeted as a result. However, the precise extent to which a similar reform may increase fiscal revenues, as well as its distributional and public health effects, would require a detailed estimation through sound simulations of relevant scenarios.

Fewer of the above conditions are met in the case of food and non-alcoholic beverages, especially if fiscal and price policies in this area evolved towards a mix of negative and positive price incentives. Starting from current levels of taxation, there is scope for marginal improvements based on evidence reviewed in this report. In particular, the tax base for the Soft Drinks Industry Levy is relatively narrow at present. As evidence of possible substitutions will emerge from early evaluations of the levy, expansions of the tax base may be considered to include some of the unwarranted substitutes or to make the aggregate demand for the taxed products less elastic (which would increase revenues).

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In the case of environment taxes, the potential for further revenue raising is significant, even in the presence of parallel use of fiscal measures to incentivise environment-friendly (and healthy) consumption. However, if hypothecation, even of the soft form, were possible, this might not be primarily or exclusively to the benefit of public health or health care.

Reducing health inequalities

Fiscal and price policies tend to have progressive health impacts because the consumption of unhealthy products tends to be more concentrated in disadvantaged socioeconomic groups, and because the latter groups tend to be more responsive to financial incentives (1). However, the use of fiscal and price measures for distributional purposes has always found a limit in the potential for regressive financial impacts.

Fiscal and price policies on alcohol beverages are the ones that are least likely to generate regressive financial impacts, although some low-income heavy consumers may be a cause for concern. Moving towards volumetric taxation would most likely improve alcohol-related health inequalities to a significant extent, without necessarily being a financially regressive policy change.

Tobacco smoking continues to be a major source of health inequalities and the potential to redress some of these through fiscal and price policies is definitely there. Incremental changes in the existing taxation system, as well as the possible introduction of minimum prices, would be beneficial measures in this direction in terms of health inequalities, but would remain financially regressive measures.

Significant inequalities in obesity, especially among children, also mean that expanding the scope for fiscal and price policies on food and non-alcoholic beverages may bring about meaningful reductions in health inequalities.

Potential trade-offs between fiscal policy goals

The discussion above highlights some potential trade-offs between goals, which may compound the design of fiscal and price policies. One such trade-off may occur between health promotion and revenue raising. The latter is unlikely to be the exclusive

goal of policies designed to improve population health, and in most cases will be combined with (direct) health improvement goals. An effective revenue raising measure should ideally target consumption that is not very responsive to price changes (inelastic demand), however, a limited response by consumers means a limited health benefit. The correct policy response to this trade-off does not necessarily involve targeting consumption that is more responsive to price changes (most of the consumption we would want to reduce for health reasons is not very responsive to prices anyway). Rather, the policy can engineer a larger response by consumers by inducing larger price changes. In other words, a large tax on a product whose demand is relatively inelastic would allow the policy to achieve good results on both the health improvement and the revenue raising sides.

Of course, the above could potentially trigger a new trade-off, between health gain and financial equity impacts, because a large tax may represent a significant financial burden for the less well off, and therefore may be undesirable from a broader welfare perspective. This means that each policy requires careful design to ensure any potential trade-offs are adequately addressed and unwarranted impacts are prevented.

Other issues

The government labelling the UK sugar-sweetened beverage tax as an “industry levy” has generated a debate around the appropriate tax point for taxes on health-related consumption, as if this was a way to shift the tax burden between suppliers and consumers. However, the government’s ability to determine who eventually bears the tax burden is very limited, regardless of the tax point. In the case of the Soft Drinks Industry Levy, it was always clear from both theory and previous experiences, including those reviewed in this report, that the tax would be largely passed on to consumers (which, of course, is a concern for industry, but it means that the tax is not simply an “industry levy”). Whether taxes can primarily, or exclusively, affect industry profitability depends, above all, on market structure and consumers’ price-responsiveness, but also on the fact that food prices vary sometimes significantly for a host of reasons, for instance by shop type. This could happen in a competitive market for products whose demand is very price-elastic, and the latter condition is not typically met in the case of health-related products.

In conclusion, taxes will inevitably affect both industry and consumers' behaviours and place some financial burden on both of these actors, either through the need for reformulation or an impact on purchasing directly. While the government may want to emphasise impacts on industry to increase acceptability by the public, it will always have limited control over how the tax burden is apportioned.

Evidence gaps

In-depth case studies of policies applicable to the UK and of particular interest to PHE could build the evidence on the health impact collected so far. In particular, interviews with key policy makers and other stakeholders could provide more contextual information and other types of evidence (aside from traditional peer-reviewed papers and reports) to help the development of further policies, as well as the interpretation of existing policies.

Public health modelling work would add further insight to this work: either by forecasting and predicting the impact of a specific fiscal or pricing policy in the UK context, by building on existing modelling work to strengthen the case for the re-design of existing policies or by allowing the evaluation of existing policies including cost-benefit analysis to help prioritisation, where the evidence is still lacking, based on this report. Extending the identified, existing modelling studies to simulate the larger system will help produce predictions about how different policies interact with one another at a population level.

The findings from this study and the framework could provide the basis to institute a national commission on health promoting fiscal policies to look into this further.

One interesting aspect would be to collaborate with behavioural insights researchers to further unpick the mechanisms by which these policies may be successful at changing behaviours and having a positive impact on health.

Another interesting developmental piece of work would be to develop guidelines for publications reporting on policies, in order to strengthen the evaluation and comparability of results.

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This work only focused on nine policy areas, so further work could extend this to an even wider set of policy areas to provide evidence for a health in all policies approach.

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- Available from:
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Appendices

Appendix A. Template of the framework

Dimension	Field	Description of field
POLICY DESCRIPTION	Policy area	Policy area the policy relates to
	Policy name	Name given to policy
	Evidence type	Note if this is an implemented policy, a modelling study or a smaller scale study
	Policy owner	List who policy is led or owned by (NA for studies/models etc.)
	Mechanism type	What is (are) the mechanism(s) of the policy?
	Mechanism details	Add detail about the specifics of the policy mechanism
	Target risk factor/behaviour/commodity	Which risk factor/product/commodity/behaviour is the policy aimed at?
	Target population/demographics	Which segment of the population is the policy targeted at?
	Setting (Geographical)	Country - region/locality - setting level (Local - Regional - National - International)
	Year of implementation	Start year of the policy. If this is not available, note the year of the oldest publication on this policy followed by an asterisk eg 2008*.
	Timeline(s)for the policy's impact assessment	What are the timelines for the policy's impact assessment/follow-up?
	Policy implementation (policy owner, voluntary vs mandatory policy, implementation mechanism (if implemented), overlap with other policies and cost of implementation)	Information on whether the policy was implemented, whether it was voluntary or mandatory, what mechanism was used for passing the policy, whether it overlaps with any other policies and any information on the cost if implementation etc.
	Follow-up actions for policy	Combination of follow-up actions and any sunset clause.
POLICY OUTCOMES	Type of analysis	Type of analysis used to derive the outcome information
	Policy outcomes (health or intermediate impact)	List of health or intermediate outcomes reported for the policy
	Quantitative outcomes (health or intermediate)	The quantitative results on health and intermediate impacts achieved by the policy (values)
	Distributional effects	What distributional effects are reported on for this policy?
	Type of economic evaluation analyses	What type of economic evaluation analysis was undertaken?
	Quantitative economic evaluation results	List or paste the quantitative results from economic evaluations.
	Revenue information (amount, beneficiary and utilisation/earmarking)	Combination of fields (Revenue, beneficiary of revenues, utilisation of revenues)

Fiscal and pricing policies to improve public health

	Other impacts (co-benefits, unintended/perverse effects)	Information on any co-benefits, other unintended perverse effects, and other non-health impacts of the policy
OTHER INFORMATION	Policy context information provided	Information provided on the context around the policy, including opponents and proponents.
	National policy presence	Has the policy been implemented nationally in England (or UK country if specified). Yes, No, NA(if not a national policy) and ? If unclear
	Reference to original sources	Author, year and if possible, link for each reference used to extract information about the policy
	Reference link	Hyperlink to PDF if freely available; URL if not.
	Digital Object Identifier	DOI for publications, if available

Appendix B. List of sources searched and detailed search strategies

PubMed strategy

The following strategy searched all terms for title/abstract and all terms underlined as Mesh terms. Search results were restricted to publication from 2008 to 7th March 2018 (date the searches were run), except for the search for gambling policies, which was extended from 2000 to 7th March 2018. A separate search was conducted for each policy area, combining the terms for each policy areas with terms for fiscal and pricing policies (1), assessment (2), eligible countries (3) and concept terms for each policy area. For instance, searches for literature on fiscal and pricing for gambling would be: 1 AND 2 AND 3 AND 8.

Outcome search terms, such as mortality, incidence, health etc were not included in the strategy. Publications were screened based on whether they contain information about an impact (or lack thereof) on health or health-related outcome.

- 4 fiscal OR tax OR taxation OR levy OR “value added tax” OR “value-added tax” OR subsid* OR price OR pricing OR discount OR incentive OR rebate OR voucher OR coupon OR elasticit* OR “government subsidy” OR taxes
- 5 effectiveness OR efficacy OR “cost effectiveness” OR cost-effectiveness OR impact OR benefit OR purchase OR benefit OR behaviour OR behavior OR model* OR simulation OR “computer simulation” OR “computer model” OR “health impact assessment” OR “program evaluation” OR “cost effectiveness” OR “computer simulation” OR “program evaluation”
- 6 australia OR australie OR australien OR austria OR autriche OR oesterreich OR oesterreich OR belgium OR belgique OR belgien OR belgio OR belgica OR belgie OR canada OR kanada OR chile OR chili OR “czech republic” OR czechia OR “republique tcheque” OR “tschechische republic” OR tschechien OR “repubblica checa” OR “repubblica ceca” OR cesk* OR denmark OR danemark OR daenemark OR danimarca OR dinamarca OR danmark OR estonia OR estonie OR estland OR eesti OR finland OR finlande OR finnland OR finlandia OR Suomi OR france OR frankreich OR francia OR germany OR allemagne OR deutschland OR alemania

OR Germania OR greece OR grece OR grecia OR griechenland OR hungary OR hongrie OR ungarn OR “ungarischen republic” OR hungria OR hungar OR “repubblica ungherese” OR iceland OR islande OR island OR islandia OR islanda OR ireland OR irlande OR irland OR irlanda OR israel OR israele OR italy OR italie OR italien OR italia OR japan OR japon OR janpanien OR giappone OR korea OR coree OR corea OR latvia OR lettonie OR lettland OR letonia OR lettonia OR latvija OR luxembourg OR luxemburg OR luxemburgo OR lussemburgo OR mexico OR mexique OR mexiko OR mejico OR messico OR netherlands OR “pays-bas” OR niederlande OR olanda OR “paesi bassi” OR “paises bajos” OR nederland OR “new Zealand” OR “nouvelle zelande” OR neuseeland OR “nueva zelanda” OR “nuova zelanda” OR norway OR norvege OR norwegen OR noruega OR norvegia OR norge OR poland OR pologne OR polen OR polonia OR polska OR portugal OR portogallo OR slovakia OR “slovak republic” OR slovaquie OR “republique slovaque” OR slovensk* OR slowakei OR “slowakische republic” OR eslovaquia OR “republica eslovaca” OR slovacchia OR “repubblica slovacca” OR slovenia OR slovenie OR slonenien OR slovenia OR eslovenia OR slovenija OR spain OR espagne OR spanien OR espana OR spagna OR sweden OR suede OR schweden OR suecia OR svezia OR sverige OR switzerland OR suisse OR schweiz OR suiza OR svizzera OR turkey OR turquie OR turkei OR turchia OR turquia OR uk OR “united kingdom” OR “royaume uni” OR “vereinigtes koenigreich“ OR “reino unido” OR “regno unito” OR “great britain” OR “grande bretagne” OR “gross britannien” OR grossbritannien OR “gran bretana” OR “gran bretagna” OR england OR angleterre OR inglaterra OR inghilterra OR scotland OR ecosse OR schottland OR escocia OR scozia OR wales OR “pays de galles” OR gales OR galles OR usa OR “united states” OR “etats-unis” OR “vereinigte staaten” OR “estados unidos” OR “stati uniti” OR “developed countries” OR “developed economies” OR “industrialized countr*” OR “industrialised countr*” OR “europe” OR “america” OR oecd OR brazil OR fiji OR Caribbean

- 7 **Diet and obesity terms:** “food and beverage” OR fruit OR vegetables OR fat OR fats OR “sugar-sweetened beverage” OR “sugar sweetened drink*” OR soda OR “soft drink” OR “carbonated drink*” OR beverage OR meat OR dairy OR candy OR sugar* OR sucrose OR sweet* OR snack* OR fastfood* OR “fast food*” OR

junkfood OR “junk food*” OR calorie OR calorie* OR “vending machine*” OR “takeaway” OR sodium OR “food and beverages” OR fruit OR vegetables OR snacks OR “sodium, dietary” OR eating OR diet OR “food intake” OR “food consumption” OR intake OR “dietary behaviour” OR “dietary behavior” OR “dietary intake” OR “eating behaviour” OR “eating behavior” OR eating OR diet OR “food intake” OR “Diet, Food, and Nutrition” OR BMI OR “body weight” OR “body mass index” OR “adiposity” OR overweight OR obesity OR obese OR “body mass index” OR adiposity OR overweight OR obesity

- 8 **Physical activity terms:** “physical activity” OR “physical fitness” OR “active lifestyle” OR moving OR move* OR walking OR sport* OR exercis* OR biking OR bike* OR bicycl* OR cycling OR walk* OR dancing OR “active transport*” OR “active travel” OR “active commut*” OR physical inactivity fitness OR “physical exertion” OR “exercise”
- 9 **Environment terms:** “ambient air pollution” OR “indoor air pollution” OR “particulate matter” OR “PM2.5” OR “black carbon” OR “PM10” OR “nitrogen dioxide” OR NO2 OR “sulfur dioxide” OR SO2 OR ozone OR O3 OR “carbon monoxide” OR emission OR “volatile organic compounds” OR emission OR “air pollution”
- 10 **Housing terms:** housing OR house OR home OR “living standards” OR “living conditions” OR housing OR “public housing”
- 11 **Gambling terms:** gambli* OR betting OR gambling OR lottery OR lotto
- 12 **Healthy workplace terms:** (staff or personnel or employe* or profession* or workplace* or worksite OR “health personnel” OR “workplace” OR Workplace) AND (intervent* or promot* or initiativ* or program* or scheme*) AND (health OR healthy OR wellness OR wellbeing OR “well-being” OR “mental health” OR exercise* OR food* OR diet* OR alcohol* OR smok* OR leisure OR fit* OR stress* OR depress* OR activ*) OR Employee Incentive Plans

- 13 **Secondary prevention activities terms:** screening OR diagnosis OR “prevention services” OR “secondary prevention” OR “vaccin*” OR “health check” OR “Mass Screening”

EconLit

The strategy for Econlit is similar to that used for Pubmed, with a title/abstract search for all terms, but MeSH terms were not used and the term “**policy**” was added to the fiscal and pricing terms. Search results were restricted to publication from 2008 to 7th March 2018 (date the searches were run), except for the search for gambling policies, which was extended from 2000 to 7th March 2018

An example of a search for gambling would be 1 AND 2 AND 3 AND 8 AND “policy”

- 1 (fiscal OR tax OR taxation OR levy OR “value added tax” OR value-added tax” OR VAT OR subsid* OR price OR pricing OR discount OR incentive OR rebate OR voucher OR coupon OR elasticit* OR “government subsidy” OR taxes) AND policy
- 2 effectiveness OR efficacy OR “cost effectiveness” OR cost-effectiveness OR impact OR benefit OR purchase OR behaviour OR behavior OR model* OR simulation OR “computer simulation” OR “computer model” OR “health impact assessment” OR “program evaluation” OR “cost effectiveness” OR “computer simulation” OR “program evaluation”
- 3 australia OR australie OR australien OR austria OR autriche OR osterreich OR oesterreich OR belgium OR belgique OR belgien OR belgio OR belgica OR belgie OR canada OR kanada OR chile OR chili OR “czech republic” OR czechia OR “republique tcheque” OR “tschechische republic” OR tschechien OR “republica checa” OR “repubblica ceca” OR cesk* OR denmark OR danemark OR daenemark OR danimarca OR dinamarca OR danmark OR estonia OR estonie OR estland OR eesti OR finland OR finlande OR finnland OR finlandia OR Suomi OR france OR frankreich OR francia OR germany OR allemagne OR deutschland OR alemania OR Germania OR greece OR grece OR grecia OR griechenland OR hungary OR hongrie OR ungarn OR “ungarischen republic” OR hungria OR hungar OR “repubblica ungherese” OR iceland OR islande OR island OR islandia OR islanda OR ireland OR irlande OR irland OR irlanda OR israel OR israele OR italy OR italie

OR italien OR italia OR japan OR japon OR japanien OR giappone OR korea OR coree OR corea OR latvia OR lettonie OR lettland OR letonia OR lettonia OR latvija OR luxembourg OR luxemburg OR luxemburgo OR lussemburgo OR mexico OR mexique OR mexiko OR mejico OR messico OR netherlands OR "pays-bas" OR niederlande OR olanda OR "paesi bassi" OR "paises bajos" OR nederland OR "new Zealand" OR "nouvelle zelande" OR neuseeland OR "nueva zelanda" OR "nuova zelanda" OR norway OR norvege OR norwegen OR noruega OR norvegia OR norge OR poland OR pologne OR polen OR polonia OR polska OR portugal OR portogallo OR slovakia OR "slovak republic" OR slovaquie OR "republique slovaque" OR slovensk* OR slowakei OR "slowakische republic" OR eslovaquia OR "republica eslovaca" OR slovacchia OR "repubblica slovacca" OR slovenia OR slovenie OR slonenien OR slovenia OR eslovenia OR slovenija OR spain OR espagne OR spanien OR espana OR spagna OR sweden OR suede OR schweden OR suecia OR svezia OR sverige OR switzerland OR suisse OR schweiz OR suiza OR svizzera OR turkey OR turquie OR turkei OR turchia OR turquia OR uk OR "united kingdom" OR "royaume uni" OR "vereinigtes koenigreich" OR "reino unido" OR "regno unito" OR "great britain" OR "grande bretagne" OR "gross britannien" OR grossbritannien OR "gran bretana" OR "gran bretagna" OR england OR angleterre OR inglaterra OR inghilterra OR scotland OR ecosse OR schottland OR escocia OR scozia OR wales OR "pays de galles" OR gales OR galles OR usa OR "united states" OR "etats-unis" OR "vereinigte staaten" OR "estados unidos" OR "stati uniti" OR "developed countries" OR "developed economies" OR "industrialized countr*" OR "industrialised countr*" OR "europe" OR "america" OR oecd OR brazil OR fiji OR Caribbean

- 4 Diet and obiesty terms: "food and beverage" OR fruit OR fruit OR vegetables OR fat OR fats OR "sugar-sweetened beverage" OR "sugar sweetened drink*" OR soda OR "soft drink" OR "carbonated drink*" OR beverage OR meat OR dairy OR candy OR sugar* OR sucrose OR sweet* OR snack* OR fastfood* OR "fast food*" OR junkfood OR "junk food*" OR calorie OR calorie* OR "vending machine*" OR "takeaway" OR sodium OR "food and beverages" OR fruit OR vegetables OR snacks OR "sodium, dietary" OR Eating OR diet OR "food intake" OR "food consumption" OR OR intake OR "dietary behaviour" OR "dietary behavior" OR

“dietary intake” OR “eating behaviour” OR “eating behavior” OR eating OR diet OR “food intake” OR “Diet, Food, and Nutrition” OR BMI OR “body weight” OR “body mass index” OR “adiposity” OR overweight OR obesity OR obese OR body mass index” OR adiposity OR overweight OR obesity OR consumption

- 5 **Physical activity terms:** “physical activity” OR “physical fitness” OR “active lifestyle” OR moving OR move* OR sport* OR exercis* OR biking OR bike* OR bicycl* OR cycling OR walk* OR dancing OR “active transport*” OR “active travel” OR “active commut*” OR physical inactivity fitness OR “physical exertion”
- 6 **Environment terms:** “ambient air pollution” OR “indoor air pollution” OR “particulate matter” OR “black carbon” OR “nitrogen dioxide” OR “sulfur dioxide” OR ozone OR “carbon monoxide” OR “volatile organic compounds” OR “air pollution” OR emission
- 7 **Housing terms:** housing OR house OR home OR “living standards” OR “living conditions” OR “public housing”
- 8 **Gambling terms:** gambli* OR betting OR lottery OR lotto
- 9 **Healthy workplace terms:** ((staff or personnel or employe* or profession* or workplace* or worksite OR “health personnel” OR “workplace” OR workplace) AND (intervent* or promot* or initiativ* or program* or scheme*) AND (health OR healthy OR wellness OR wellbeing OR “well-being” OR “mental health” OR exercise* OR food* OR diet* OR alcohol* OR smok* OR leisure OR fit* OR stress* OR depress* OR activ*)) OR “Employee Incentive Plans”
- 10 **Secondary prevention activities terms:** screening OR diagnosis OR “prevention services” OR “secondary prevention” OR “vaccin*” OR “health check” OR “mass Screening”

Google Scholar

A more succinct combination of terms was searched for each policy areas, filtered for 2008-2018 (2000 for gambling policies). Hits were sorted by relevance and the first 3 pages of hits were be screened and relevant references included

- 1 ("fiscal policy" OR "fiscal policies" OR taxes OR subsidy) AND (diet OR obesity OR overweight OR food OR fat)
- 2 "fiscal policy" OR "fiscal policies" OR taxes OR subsidy) AND (“physical activity” OR transport”)
- 3 "fiscal policy" OR "fiscal policies" OR taxes OR subsidy) AND (environment OR pollution)
- 4 "fiscal policy" OR "fiscal policies" OR taxes OR subsidy) AND (housing)
- 5 "fiscal policy" OR "fiscal policies" OR taxes OR subsidy) AND (gambling)
- 6 "fiscal policy" OR "fiscal policies" OR taxes OR subsidy) AND (health) AND (“workplace” OR “employee)
- 7 "fiscal policy" OR "fiscal policies" OR taxes OR subsidy) AND (health) AND (prevention OR screening)

Grey literature

In addition to peer-reviewed literature, we searched Google using the same keyword search strategy as for Google Scholar and searched international organisation websites including OECD, World Bank, WHO, IMF, IFS for further sources of information. We searched these organisational websites in two ways, once by browsing them individually for relevant publications and we ran the Google keyword searches for each policy area, using the site filter function in Google. Eg to search the World Health Organisation, we ran the separate policy area searches, adding “site:who.int”.

In addition, we searched the following websites:

For tobacco and alcohol, specific topics of interest were searched, and therefore specific literature search strategies were devised and used across PubMed, EconLit and Google Scholar.

Tobacco specific searches

E-cigarette taxation strategy

- 8 e-cig* OR electr* cigar* OR “electronic nicotine” OR vape or vaper or vapers or vaping
- 9 fiscal OR tax OR taxation OR levy OR “value added tax” OR “value-added tax” OR subsid* OR price OR pricing OR discount OR incentive OR rebate OR voucher OR coupon OR elasticit* OR “government subsidy” OR taxes
- 10 11 AND 12 AND 3 [limited to 2008 onwards]

Minimum unit pricing for tobacco products

- 11 "minimum unit pricing" OR "minimum unit price" OR "minimum pricing" OR "minimum price" OR "floor price" OR "floor pricing" OR “Pack price” OR “stick”
- 12 smoking OR cigarette OR tobacco OR smok* OR nicotine OR smoking OR tobacco
- 13 14 AND 15 AND 3 [limited to 2008 onwards]

Tobacco levy experience in the USA and France

- 14 levy[Title/Abstract])
- 15 smoking OR cigarette OR tobacco OR smok* OR nicotine OR smoking OR tobacco
- 16 14 AND 15 AND “france OR frankreich OR francia OR usa OR “united states” OR “etats-unis” OR “vereinigte staaten” OR “estados unidos” OR “stati uniti”) [limited to 2008 onwards]

Incentives for smoking cessation in pregnancy

- 17 pregnan* OR antenatal* OR gestation* OR pregnancy OR "socio-economic status" OR "socio economic status" OR “socioeconomic factors” OR “social class” OR “educational status” OR “educational level” OR “socioeconomic condition” OR “socioeconomic level“ OR “socioeconomic determinant” OR “social determinant” OR income OR poverty OR “occupational class”
- 18 smoking OR cigarette OR tobacco OR smok* OR nicotine OR smoking OR tobacco
- 19 subsid* OR price OR pricing OR discount OR incentive OR rebate OR voucher OR coupon OR elasticit* OR “government subsidy”
- 20 20 AND 21 AND 22 AND 3 [limited to 2008 onwards]

Alcohol specific searches

Drink – drinking : incentives for drinking lower strength alcohol

- 21 “Automobile Driving” OR “Motor Vehicles” OR Automobiles OR “Accidents, Traffic”
OR car or cars or automobile* or auto-mobile* or auto mobile* or automot* or auto-
mot* or auto mot* or motor* or vehicle* OR driv* OR passenger* OR (traffic* or
road* or street* or highway* or motorway*) and (accident* or safe* or crash* or injur*
or death* or mortal* or fatal*)
- 22 “Drinking Behavior” OR “Alcoholic Beverages” OR Ethanol OR Alcoholism OR
“Alcoholic Intoxication” OR ethanol* OR alcohol* OR drink* OR intoxicat* OR
inebriat* or inebriet* OR impair* OR drunk*
- 23 subsid* OR price OR pricing OR discount OR incentive OR rebate OR voucher OR
coupon OR elasticit* OR “government subsidy”
- 24 24 AND 25 AND 26 AND 3 [limited to 2008 onwards]

Evidence from outside EU on a more rational approach to alcohol duty

- 25 duty OR levy OR tariff OR excise OR fiscal OR tax OR taxation OR levy OR “value
added tax” OR “value-added tax” OR VAT
- 26 alcohol* OR spirits OR beer OR wine OR cider OR drink OR liquor OR Alcohol
Drinking
- 27 evaluation OR implementation
- 28 non EU OECD countries from 3
- 29 28 AND 29 AND 30 AND 31 [limited to 2008 onwards]

Appendix C. Summary of external contacts responses

A total of 74 national and international experts from academia, international health organisations and ministries of health and finance were contacted. Twenty one responded and 14 provided documentation or signposted to references that might be of interest, resulting in a total of 98 documents. The majority (63) were general tobacco taxation documentation, 18 referred to the diet and obesity, 4 were alcohol policy related and 3 related to the environment, while 10 encompassed more than one policy area.

Appendix D. Framework user guide

This framework contains an *Introduction* tab which links to the report for additional information on the methodology for this framework, as well as a *User Guide* tab, and 10 tabs which contain the extracted information on all policies combined, and then separately by policy area.

The format of each of these frameworks is identical and is set up so that each row represents a policy result, and each column represents a dimension of the policy that was extracted from the publications and reports. These dimensions or columns are split into 3 sections (See Appendix A): The first set of columns describe the policy, the second describe the outcomes of the policy and the final set provide additional information on the context external to the policy, as well as the references and links to publications from which the information was extracted.

There are three main ways in which this framework can be queried: The framework in MS Excel is designed to be searched using the filtering options available for each column.

One option is to focus on results within a particular policy area and sort on a specific policy type using the filter option in the **Mechanism type** field, and selecting one subset of fiscal and pricing policies (eg Financial incentives). This will narrow the results down to only financial incentive policies. Further filtering can then be applied, for example, to the **Target risk factor/behaviour/commodity (eg Health screens)** to focus on a specific subset of financial incentives. It is also possible to filter on the **Target**

Fiscal and pricing policies to improve public health

Population/ demographics field, or the **Setting (Geographical)** to further refine the subset of financial incentive policies.

Conversely, it is possible to filter firstly on the **Target risk factor/behaviour/commodity** and look through the evidence for all types of policies aimed at a specific commodity (eg all policies targeting F&V (Fruit and Vegetables)).

One further option is to apply the same methods but to the *All Areas Combined* tab to look through the evidence across policy areas, in the same ways as the example above.

The last two columns provide the reference and links to the full-text articles and sources of information used for each policy extracted.