

# Translating the World Health Organization 25x25 goals into a United Kingdom context: The PROMISE study

## Final Report

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## EXECUTIVE SUMMARY

The World Health Organization (WHO) Global Non-Communicable Disease (NCD) Action Plan 2013-2020<sup>1</sup> sets targets for improvements in the prevalence of NCD risk factors, specifically obesity, diabetes, raised blood pressure, tobacco use, salt intake, physical inactivity and harmful use of alcohol. The Richmond Group of Charities commissioned the BHF Centre on Population Approaches for Non-Communicable Disease Prevention to run a research project which translates the WHO targets into a UK health context. We did this in a two stage process – a modelling project using innovative methods to estimate the NCD burden in England between 2010 and 2025 if the WHO 25 by 25 targets are met; and a policy review of the potential prevention-based population-level interventions that are available for reducing poor diet, physical inactivity, smoking and alcohol consumption. In addition, we modelled the potential health impact of four interventions: food reformulation; physical activity behaviour change advice delivered through primary care; increased tax on tobacco at above inflation rates; further restrictions of alcohol marketing.

### Modelling study

We projected trends in the seven risk factors to 2025 and developed a population and mortality model to forecast mortality and disability from NCDs in the UK to 2025. These projections provided a business as usual (BAU) scenario for comparison with scenarios where the UK achieves the WHO 25 by 25 targets. Using relative risks describing dose-response relationships from meta-analyses of prospective observational studies, we related the seven risk factors with the following NCDs: coronary heart disease; stroke; type 2 diabetes; hypertensive disease; chronic obstructive pulmonary disease; liver cirrhosis; kidney disease; and cancers of the following sites: mouth, oesophagus, larynx, colon/rectum, liver, pancreas, lung, kidney, breast, cervix, stomach and bladder. We also included the relationship between the risk factors and depression and dementia in the modelling exercise, but note that the strength of the evidence relating the risk factors and these NCD outcomes is not as strong as for the other NCDs.

Under the BAU scenario, the probability of dying between the age of 30 and 70 fell by 22% in men and 25% in women by 2025 (note that this definition of premature mortality is the same measure which the WHO use to benchmark progress towards the 25 by 25 targets reported in the NCD Action Plan and does not include mortality from depression or dementia). Achieving all of the seven risk factor targets resulted in both men and women achieving the 25% reduction in premature mortality by 2025 in comparison to 2010. The biggest reduction in premature mortality was achieved by the obesity target (to halt the rise in overweight and obesity).

Including deaths at all ages, achieving all of the WHO 25 by 25 targets would result in 161,000 (135,000 to 206,000) deaths delayed or averted in men and 89,000 (70,000 to 107,000) in women by 2025, most of which are due to reduced rates of coronary heart disease and stroke. We also modelled the impact of achieving the targets on disability from NCDs, measured in terms of 'years of life lost to disability (YLDs)'. Achieving all of the targets would reduce YLDs by 630,000 (570,000 to 690,000) in men and 490,000 (460,000 to 520,000) by 2025, with substantial contributions to this reduction due to falls in prevalence of diabetes, coronary heart disease, stroke and chronic

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<sup>1</sup> World Health Organization. *WHO Global NCD Action Plan 2013-2020*. WHO: Geneva, 2013.

obstructive pulmonary disease. Including depression and dementia in these analyses increases the reduction in disability considerably.

Most of the reductions in mortality and disability are due to meeting the 25 by 25 targets for obesity and diabetes. However, this is primarily due to the ambitious nature of these targets, which will require the cessation of increases in the prevalence of both obesity and diabetes. In contrast the remaining 25 by 25 targets call for a proportional reduction in the prevalence of risk factors that are already falling in the UK.

### **Policy review**

We conducted a purposive scoping review of the literature to identify policy intervention options to address each of the four main risk factors for NCDs, namely poor diet, physical inactivity, smoking, and alcohol consumption. We focused our search on review-level evidence from the peer-reviewed journals and supplemented this search by exploring web-based sources of grey literature aimed specifically at a policy making audience, some of which includes non-review level evidence.

To be included, each identified intervention had to meet the following criteria:

- Must be aimed at addressing diet and/or physical inactivity and/or smoking and/or alcohol consumption.
- Must be supported by review-level data published in English from January 2005 onwards (end date December 2014), except for grey literature.
- Must be non-clinical.
- Must be 'population-based'.

We included 16 sources of evidence about alcohol-related interventions, 27 about interventions around diet, 26 about physical activity related interventions and 36 about smoking interventions. Having extracted standard data from each source, we categorised them into intervention types. Nineteen experts nominated by the Richmond Group helped to refine the identified intervention options until we had a long list of potential policy intervention options for each of the four risk factors. A workshop was held where experts were asked to assess the identified interventions against a range of criteria in order to produce a short list of possible policy options to be taken forward. Following the workshop, and after further discussion within the Richmond Group, the following 12 policy intervention options were shortlisted for data extraction for the policy review:

- *Poor diet*
  - Sugar sweetened beverage tax
  - Reformulation of packaged food, including portion size control
  - Further restriction of unhealthy food marketing
- *Physical inactivity*
  - Redesign urban environments to prioritise walking and cycling
  - Support for community groups that encourage physical activity

- Behaviour change advice service, delivered through primary care
- *Smoking*
  - Maintain increases of tax on tobacco at above inflation rates
  - Tackling illicit trade in cigarettes
  - Increased support for smoking cessation services, particularly in hard to reach groups
- *Alcohol*
  - Regulation to raise the price of high strength cheap alcohol
  - Strengthen local authority control over licensing powers
  - Further restriction of alcohol marketing

A narrative summary of evidence relating to each chosen intervention option is provided. This evidence strengthens the case for the prioritisation of prevention action but our review, across the four risk factors, uncovers three key challenges that will restrict further progress (i) developing and maintaining evidence and advocacy for the four risk factors; (ii) identifying workable solutions; and (iii) encouraging policy makers to support and implement solutions.

There is a need for smarter research not only to generate and develop the evidence base for each risk factor, and to continue to evaluate policy interventions, but also to build a new evidence base around implementation. We found a dearth of evidence on the implementation of policies and practices that would improve diets, levels of physical inactivity, smoking and alcohol intakes.

Our modelling exercises showed that the four selected interventions could have a substantial impact on mortality and disability from NCDs, ranging from a reduction in 1,500 (1,300 to 1,700) deaths in men and 950 (860 to 1,100) in women up to 2025 with increased tobacco taxation to 44,000 (2,900 to 85,000) deaths in men and 34,000 (-43,000 to 110,000) deaths in women up to 2025 for a total ban on alcohol advertising (see table). Differences in the size of the effect are related to the extent of the ambition of the interventions compared to current practice and difference in the uncertainty range reflects large differences in the evidence base associated with implementation of these interventions. Modelling of the interventions demonstrates that even modest population-level approaches to prevent NCDs can have a substantial impact on future disease burden in the UK.

**Table: Total NCD deaths and YLDs that are averted or delayed between 2015 and 2025, for each intervention.**

	Deaths		YLDs	
	Men	Women	Men	Women
Food reformulation	14,000 (2,500 to 25,000)	12,000 (1,700 to 22,000)	51,000 (40,000 to 63,000)	63,000 (53,000 to 73,000)
Tobacco tax increase	1,500 (1,300 to 1,700)	950 (860 to 1,100)	11,000 (11,000 to 12,000)	14,000 (14,000 to 14,000)
Alcohol marketing restrictions	44,000 (2,900 to 85,000)	34,000 (-43,000 to 110,000)	64,000 (23,000 to 110,000)	22,000 (-55,000 to 99,000)
Physical activity behaviour change	5,800 (2,800 to 8,800)	5,800 (2,300 to 9,400)	43,000 (40,000 to 46,000)	55,000 (52,000 to 59,000)

*NB. Values are mean and 95% uncertainty intervals.*



## INTRODUCTION

Non-communicable diseases (NCDs) present a huge health burden to all countries worldwide, whether industrialised or developing, and the UK is no exception. In the most recent year for which comparable estimates are available (2013), NCDs were responsible for over 38 million deaths worldwide, more than two thirds of all global deaths<sup>2</sup>. Although rates of NCDs are generally falling in most countries, the absolute number of NCD deaths is increasing due to an ageing global population<sup>3</sup>. NCDs also cause a huge (and growing) amount of disability, contributing to the loss of more than 600 million years of healthy life in 2013<sup>4</sup>.

In the UK, NCDs contribute to the vast majority of deaths and disability, despite falling death rates for many conditions. Cardiovascular diseases (CVD) and cancers are the two leading causes of deaths, responsible for 27% and 29% of all deaths in the UK in 2014<sup>5</sup>, despite both seeing substantial falls in death rates over recent decades (e.g. age-standardised mortality rates for cardiovascular diseases have fell by 74% between 1969 and 2013)<sup>6</sup>. Disability for both cardiovascular disease and cancer are currently increasing, due to a combination of an ageing population and improvements in survival rates meaning people are living longer with chronic conditions<sup>7</sup>. Age-standardised disability rates from diabetes have risen by nearly 20% since 1990, alongside increases in the prevalence of overweight and obesity<sup>8</sup>. Over the same time period death and disability rates of liver cirrhosis have risen by over 50%, whilst there have been falls in death rates and disability from chronic obstructive pulmonary disease (COPD) mirrored by reductions in the prevalence of smoking<sup>9</sup>. Meanwhile, despite small falls in the disability associated with both conditions, depression and dementia now make bigger contributions to the total burden of NCDs in England, with depression being the fourth biggest contributor to ill health in England, behind back pain, coronary heart disease and skin diseases<sup>10</sup>.

There is a large and growing body of evidence that describes the relationship between these NCDs and modifiable behavioural risk factors, the most important of which are poor diet, physical inactivity, smoking and alcohol consumption and their related medical conditions of overweight / obesity, raised blood pressure, raised cholesterol and diabetes. The Global Burden of Disease study estimates that in 2013 behavioural risk factors were responsible for 30% of mortality and disability

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<sup>2</sup> GBD 2013 Mortality and Causes of Death Collaborators. Global, regional, and national age–sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, 2015;385:117-171.

<sup>3</sup> *ibid*

<sup>4</sup> GBD 2013 Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, 2015;386:743-800.

<sup>5</sup> Townsend N, Bhatnagar P, Wilkins E, Wickramasinghe K, Rayner M. *Cardiovascular disease statistics 2015*. British Heart Foundation: London, 2015. <https://www.bhf.org.uk/publications/statistics/cvd-stats-2015>

<sup>6</sup> *ibid*

<sup>7</sup> Newton J, Briggs A, Murray C, Dicker D, Foreman K, Wang H, et al. Changes in health in England, with analysis by English regions and areas of deprivation, 1990-2013: a systematic analysis for the Global Burden of Disease 2013. *Lancet*, 2015;doi:10.1016/S0140-6736(15)00195-6.

<sup>8</sup> Institute of Health Metrics and Evaluations. *Global Burden of Disease Evaluations – Data visualisations*. <http://www.healthdata.org/data-visualization/gbd-compare> Accessed January 2016.

<sup>9</sup> *ibid*

<sup>10</sup> *ibid*

worldwide, with the associated metabolic risk factors responsible for 16%<sup>11</sup>. In England, poor diet and smoking are each responsible for greater than 10% of all death and disability, with alcohol consumption and physical inactivity also making important contributions<sup>12</sup>. Whilst recent years have seen positive trends in some risk factors in the UK with the prevalence of smoking falling and physical activity levels rising, there have also been some adverse trends – notable increases in obesity and diabetes<sup>13</sup>.

The large burden of NCDs that is due to modifiable behaviours suggests that prevention can be an important tool for reducing disease burden. The World Health Organization (WHO) has developed a strategy to reduce premature mortality from NCDs by 25% by the year 2025, by setting targets for improvements in obesity, diabetes, raised blood pressure, tobacco use, salt intake, physical inactivity and harmful use of alcohol (the so-called ‘25 by 25 targets’)<sup>14</sup>. These targets are shown in table 1 below. A modelling study by Kontis et al. has shown that achievement of these targets would reduce global premature mortality from CVD, cancer, diabetes and COPD by 22% in men and 19% in women between 2010 and 2025<sup>15</sup>. But premature mortality is not the only measure of ill health. Whereas the diseases included in the Kontis et al. analysis are responsible for 87% of all NCD deaths worldwide, they only contribute to 57% of the disability burden from NCDs<sup>16</sup>. And the analysis does not include NCDs that make a substantial impact on disease burden in the UK, such as depression and dementia.

The WHO 25 by 25 targets will dominate the NCD policy landscape for the foreseeable future and their publication represents a challenge to national policy makers to develop comprehensive prevention-based health policies. In order to build and maintain momentum towards achieving these goals, each country has been challenged to review potential priority interventions and report on current progress towards their implementation<sup>17</sup>. The Richmond Group of charities have called for prioritising prevention in the UK, with their call for prevention to be ‘at the heart of the health service and at the centre of all policy decisions’<sup>18</sup>.

In this report, we set out policy options that are available in the UK in order to transform the landscape of prevention of NCDs, informed by reviews of the evidence and an expert workshop held in July 2015. We also quantify the health impact of meeting the 25 by 25 targets in England,

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<sup>11</sup> GBD 2013 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*, 2015;386:2287–2323.

<sup>12</sup> Newton J, Briggs A, Murray C, Dicker D, Foreman K, Wang H, et al. Changes in health in England, with analysis by English regions and areas of deprivation, 1990–2013: a systematic analysis for the Global Burden of Disease 2013. *Lancet*, 2015;doi:10.1016/S0140-6736(15)00195-6.

<sup>13</sup> Townsend N, Bhatnagar P, Wilkins E, Wickramasinghe K, Rayner M. *Cardiovascular disease statistics 2015*. British Heart Foundation: London, 2015. <https://www.bhf.org.uk/publications/statistics/cvd-stats-2015>

<sup>14</sup> World Health Organization. *WHO Global NCD Action Plan 2013–2020*. WHO: Geneva, 2013.

<sup>15</sup> Kontis V, Mathers C, Rehm J, Stevens G, Shield K, Bonita R, Riley L, Poznyak V, Beaglehole R, Ezzati M. Contribution of six risk factors to achieving the 25x25 non-communicable disease mortality reduction target: a modelling study. *Lancet*, 2014;384(9941):427–437.

<sup>16</sup> Pearce N, Ebrahim S, McKee M, Lamptey P, Barreto M, Matheson D, et al. The road to 25x25 how can the five-target strategy reach its goal? *Lancet Global Health*, 2014;2(3):e126–128.

<sup>17</sup> Beaglehole R, Bonita R, Ezzati M, Alleyne G, Dain K, Kishore S, Horton R. NCD countdown 2025: accountability for the 25x25 NCD mortality reduction target. *Lancet*; 2014;384(9938):105–107.

<sup>18</sup> The Richmond Group of Charities. *What is Preventing Progress?* Richmond Group: London, 2014. <http://www.richmondgroupofcharities.org.uk/publications>

including a broad range of NCDs (CVD, cancer, COPD, cirrhosis, diabetes, depression, dementia and kidney disease) and calculating the impact on both mortality and disability. And we also quantify the likely impact on health of four potential policy initiatives aimed at preventing NCDs by improving diets, reducing physical inactivity, cutting smoking and addressing problem alcohol consumption. The rest of this report provides an overview of the methods used for the policy review and the modelling studies followed by an in-depth discussion of the results, and then a conclusion. Full details of the methods used for the study can be found in the technical appendix.

**Table 1: The WHO 25 by 25 targets**

<i>Risk factor</i>	<i>25 by 25 target†</i>
Salt consumption	30% reduction in salt / sodium intake
Physical inactivity	10% reduction in physical inactivity
Smoking	30% reduction in tobacco use
Alcohol consumption	10% reduction in harmful use of alcohol
Obesity	0% increase in obesity
Diabetes	0% increase in diabetes
Raised blood pressure	25% reduction in raised blood pressure

*†Targets are to be met by 2025, in comparison to 2010 figures*

## METHODS

This report provides the results of the PROMISE study, which incorporated a Policy Review and a Modelling Study. In this section the methods for the policy review and the modelling study are described briefly to give an indication of how the PROMISE study was conducted. Full details of the methods used for the studies are available in the Technical Appendix.

### Modelling study

To estimate the impact of the WHO 25 by 25 targets on NCD mortality and disability in England we first had to project a baseline scenario of disease burden to 2025. This baseline scenario represents a business as usual (BAU), where current efforts to prevent and treat NCDs are expected to continue up to 2025. Since the burden of most NCDs is currently on a downward trend, this means the BAU scenario will result in falls in NCD burden. In modelled scenarios where risk factor trends are changed, the results are compared against this BAU scenario.

To project the baseline scenario, we first projected population figures for England to 2025 using published projections of fertility and mortality rates and deriving estimates for migration. We then sub-divided the total mortality rates by the NCDs of interest by projecting the proportion of all-cause mortality from each condition since 2000, using a method developed for the Global Burden of Disease study<sup>19</sup>. To estimate disability for each condition, we applied age-specific estimates of the proportion of years lived in disability to mortality rates.

We used data from the Health Survey of England<sup>20</sup> and National Diet and Nutrition Survey<sup>21</sup> datasets to estimate age-specific trends in the prevalence of the seven risk factors between 1995 and 2012. We then produced BAU projections of these trends to 2025 using similar methods as those developed for the Foresight report on obesity<sup>22</sup>.

To model the 25 by 25 scenarios, we needed to connect the changes in risk factor prevalence with changes in disease outcomes and to do this we calculated population impact fractions (PIFs) for each scenario. These were calculated using a comparative risk assessment model called PRIME which has been used for many analyses of the impact of prevention-based interventions in the UK and elsewhere<sup>23</sup>. The PIFs were based on meta-analyses of randomised and observational studies of the relationship between the risk factors and the NCD outcomes. A detailed account of the studies included in the PRIME model is provided in the Technical Appendix.

We applied the 25 by 25 targets to the BAU projections of risk factors and used the year-by-year differences in the BAU projection and the scenarios to calculate age-specific PIFs, which were

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<sup>19</sup> Salomon J, Murray C. The epidemiologic transition revisited: compositional models for causes of death by age and sex. *Population and Development Review*, 2002;28:205-228.

<sup>20</sup> Joint Health Surveys Unit. *Health Survey for England 2012, and previous editions*. HSCIC: Leeds, 2014.

<sup>21</sup> NatCen. *The National Diet and Nutrition Survey: Results from years 1-4 (combined) of the rolling programme (2008/09 – 2011/12), and previous editions*. Public Health England: London, 2014

<sup>22</sup> McPherson K, Marsh T, Brown M. *Foresight. Tackling obesity – modelling future trends in obesity and the impact on health*. Government Office for Science: London, 2007.

<sup>23</sup> Scarborough P, Harrington R, Mizdrak A, Zhou M, Doherty A. The Preventable Risk Integrated ModEl (PRIME) and its use to estimate the health impact of public health policy scenarios. *Scientifica*, 2014;doi:10.1155/2014/748750.

applied to disease rates in the model to produce scenario estimates of the impact of the 25 by 25 targets on NCD mortality and disability.

In order to estimate the health impact of selected policy initiatives, we first modelled the impact of these initiatives on the prevalence of risk factors for disease using the best available evidence on efficacy of the interventions and their potential uptake and reach within the population. This provided us with estimates of the effect of the policy initiatives, which we used to calculate PIFs and apply to the disease model in the same way as described earlier.

### **Policy review**

We conducted a purposive scoping review of the literature to identify policy intervention options to address poor diet, physical inactivity, tobacco smoking, and harmful alcohol consumption. We focused our search on review-level evidence from the peer-reviewed journals and supplemented this search by exploring web-based sources of grey literature aimed specifically at a policy making audience, some of which included non-review level evidence. To identify this evidence we searched the TRIP database, the Cochrane Library, PubMed, Google Scholar, NICE Guidelines, and carried out focused searches of publication lists in key websites of other UK government bodies (Department of Health, Food Standards Agency) and non-governmental organisations (Ash, Sustain, Alcohol Research UK).

### **Box 1: Inclusion criteria for interventions**

***To be included in the policy review, an intervention must meet each of the following criteria:***

- 1 Must be aimed at addressing diet and/or physical inactivity and/or smoking and/or alcohol.
- 2 Must be supported by review-level data published in English from January 2005 onwards (end date December 2014), except for grey literature.
- 3 Must be non-clinical.
- 4 Must be population-based.

We identified 16 sources of evidence about alcohol-related interventions, 27 about interventions around diet, 26 about physical activity related interventions and 36 about smoking interventions. The list of intervention options was submitted to a group of 19 experts nominated by the Richmond Group to refine the identified intervention options into a long list of potential policy intervention options for each of the four risk factors. This longlist was considered at a day long workshop hosted by the British Heart Foundation in July 2015. Invitees included public health experts from academia, government bodies, and health-related NGOs, some of whom had provided comments in the expert consultation stage. The workshop asked the experts to assess the longlist of interventions generated by the scoping review against a range of criteria in order to produce a shortlist of possible policy options for further review of the evidence. The criteria used by the experts were: size of population impact; resources required; impact on health inequalities; political acceptability; and strength of evidence.

After the workshop the recommendations of the experts were refined by the Richmond Group into the list of 12 interventions shown in box 2 below. The sources of evidence identified in the scoping review were then used to review the evidence regarding implementation of these policy options.

**Box 2: Shortlist of prioritised intervention options for poor diet, physical inactivity, smoking and alcohol consumption**

<p style="text-align: center;"><b>Alcohol</b></p> <p>Regulation to raise the price of high strength cheap alcohol</p> <p>Strengthen local authority control over licensing powers</p> <p>Further restriction of alcohol marketing</p>	<p style="text-align: center;"><b>Diet</b></p> <p>Sugar sweetened beverage tax</p> <p>Reformulation of packaged food, including portion size control</p> <p>Further restriction of unhealthy food marketing, including pre-watershed broadcast advertising, online marketing and restrictions on sporting event sponsorship</p>
<p style="text-align: center;"><b>Physical activity</b></p> <p>Redesign urban environments to prioritise walking and cycling</p> <p>Support for community groups that encourage physical activity</p> <p>Behaviour change advice service, delivered through primary care</p>	<p style="text-align: center;"><b>Smoking</b></p> <p>Maintain increases of tax on tobacco at above inflation rates</p> <p>Tackling illicit trade in cigarettes</p> <p>Increased support for smoking cessation services, particularly in hard to reach groups</p>

## RESULTS

### Modelling study

Here we present the results of modelling the 25 by 25 scenarios in England (the effect of selected policy interventions are presented alongside the results of the policy review). Throughout this report we present two sets of modelled results – the main results which include depression and dementia as outcomes, and secondary results where these conditions are not included. This is because the evidence relating a link between the risk factors and both dementia and depression is less established than for the other disease outcomes. In some cases the mechanisms are unclear<sup>24</sup>, or previous results investigating the relationship have been highly heterogeneous<sup>25</sup>. Meta-analyses of the relationship between risk factors and depression and dementia are often not based on analyses adjusted for other risk factors, increasing the risk of confounding<sup>26</sup>.

Initially, we investigated whether the achievement of the 25 by 25 targets in England would reduce premature mortality from NCDs by 25% by 2025. This is the WHO target for NCD prevention<sup>27</sup> and their definition of NCDs does not include liver cirrhosis, depression and dementia. Therefore we excluded them from this analysis. Under the BAU scenario (i.e. following current trends in disease burden), the probability of dying between 30 and 70 years of age from NCDs is expected to fall from 17.6% in 2010 to 13.7% in 2025 for men, and from 11.9% in 2010 to 8.9% in 2025 for women (Figure 1). The projected BAU changes in premature mortality equate to relative reductions of 22% for men and 25% for women.

Achieving the 25 by 25 targets reduces the probability of premature NCD mortality for both men and women (Figure 1). In our projections the additional benefit ranges from an extra 0.1% reduction for men and women, if prevalence of physical inactivity can be reduced by 10%, up to an extra 2.3% reduction for men and 1.1% reduction for women, if the rise in obesity is halted. Achieving all seven behavioural risk factor targets combined would lead to both men and women reaching the 25% premature mortality reduction target by 2025 (Table 2).

We also modelled the impact of achieving the 25 by 25 targets on deaths at all ages, including those from depression and dementia (Figure 2 and Table 3). Because of the strong relationship between age and NCDs, most of the reduction in deaths happens in older age groups where over 200,000 deaths would be averted or delayed by 2025. Most of the delayed and averted deaths are from CHD or stroke, with a sizeable contribution (over 17,000) from dementia. As with the analysis of premature mortality, the biggest contributor to reductions in mortality was halting the rise in obesity.

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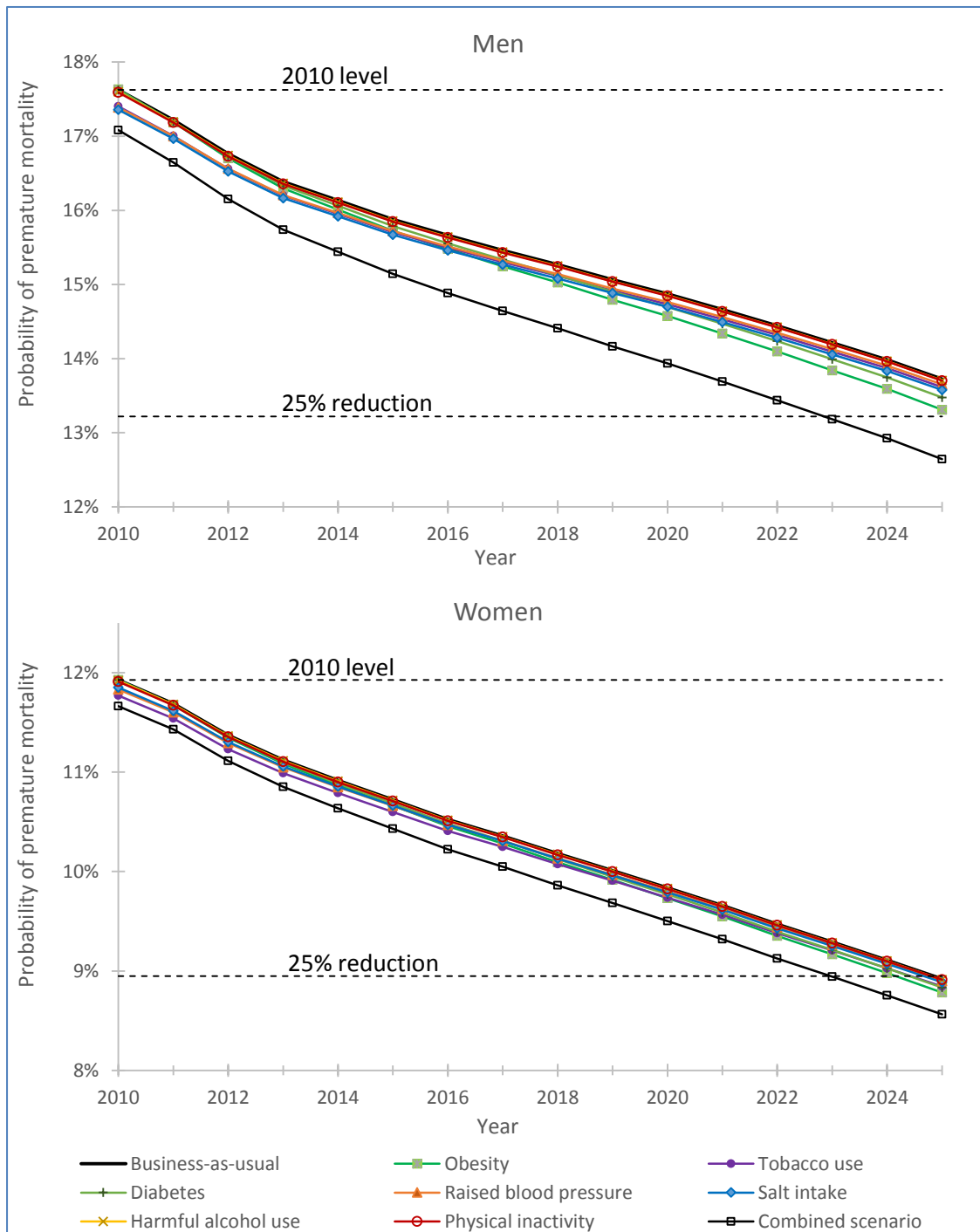
<sup>24</sup> Baumgart M, Snyder H, Carrillo M, et al. Summary of the evidence on modifiable risk factors for cognitive decline and dementia: a population-based perspective. *Alzheimer's & Dementia*, 2015;718-726.

<sup>25</sup> Valkanova V, Ebmeier K. Vascular risk factors and depression in later life: a systematic review and meta-analysis. *Biology Psychiatry*, 2013;73:406-413.

<sup>26</sup> Cheng G, Huang C, Deng H, Wang H. Diabetes as a risk factor for dementia and mild cognitive impairment: a meta-analysis of longitudinal studies. *Internal Medicine Journal*, 2012;484-491.

<sup>27</sup> World Health Organization. *WHO Global NCD Action Plan 2013-2020*. WHO: Geneva, 2013.

**Figure 1: Projected trends in the probability of dying prematurely from non-communicable disease for the business as usual and 25 by 25 target scenarios.**



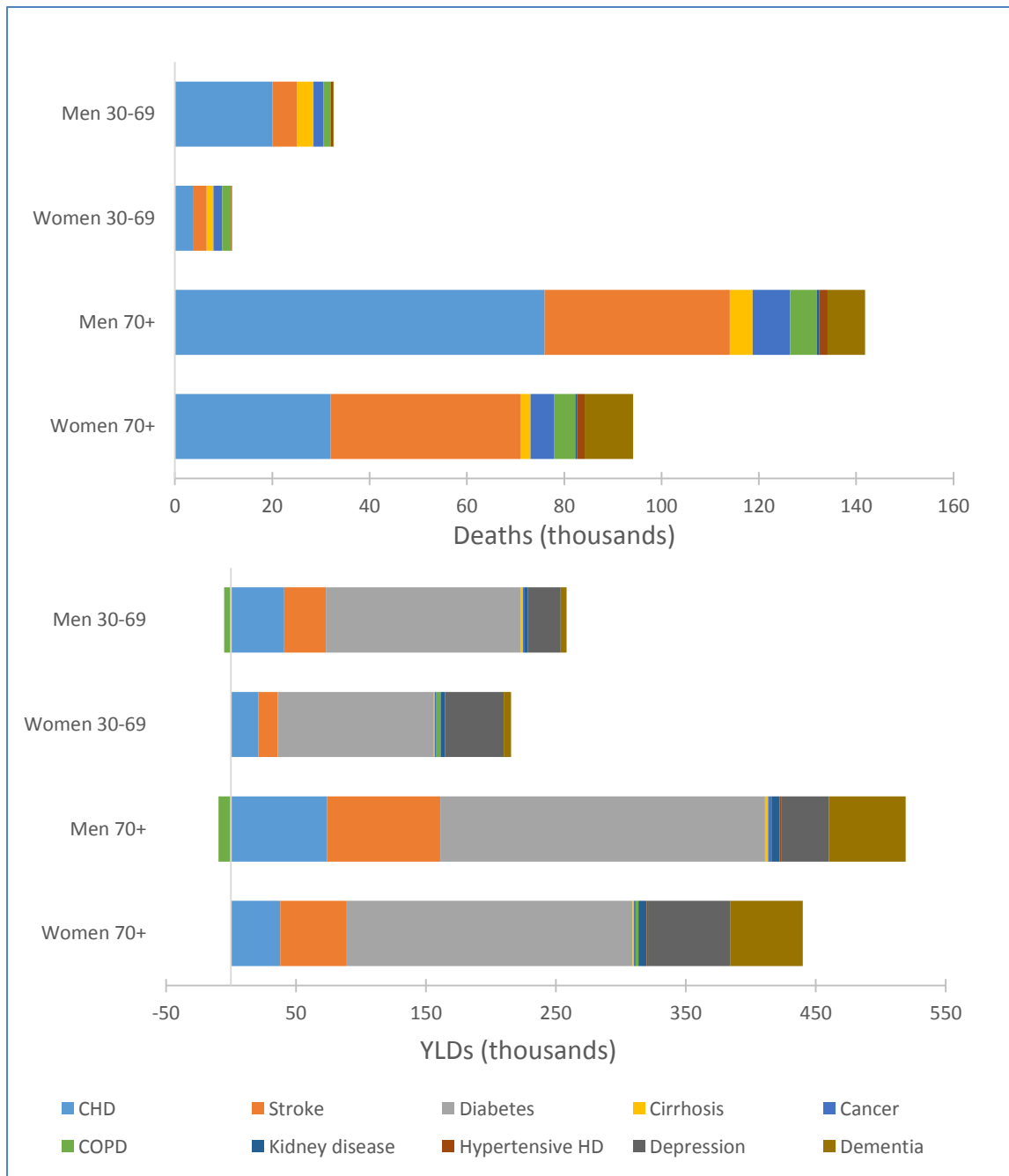


**Table 2: Relative reduction in probability of premature mortality from non-communicable diseases by 2025.**

	WHO risk factor targets		Proportion of risk addressed	
	Men	Women	Men	Women
<b>Business-as-usual</b>	22%	25%		
<b>Additional reduction if achieving risk factor targets or ideal risk scenario:</b>				
<b>Obesity</b>	2.3% (1.6% to 2.9%)	1.1% (0.3% to 1.9%)	29%	24%
<b>Tobacco use</b>	0.6% (0.6% to 0.7%)	0.6% (0.6% to 0.7%)	5%	7%
<b>Diabetes</b>	1.4% (1.2% to 1.7%)	0.7% (0.6% to 0.8%)	53%	51%
<b>Raised blood pressure</b>	0.4% (0.4% to 0.4%)	0.2% (0.2% to 0.2%)	25%	25%
<b>Salt intake</b>	0.8% (0.8% to 0.9%)	0.3% (0.3% to 0.3%)	39%	40%
<b>Harmful alcohol use*</b>	0.6% (0.4% to 0.8%)	0.3% (0.22% to 0.5%)	62%	11%
<b>Physical inactivity</b>	0.1% (0.08% to 0.1%)	0.1% (0.0% to 0.1%)	10%	10%
<b>Combined scenario</b>	6.5% (5.4% to 7.5%)	3.2% (2.2% to 4.1%)	25%	17%

*NB. Values are mean and 95% uncertainty intervals. \* Low-level consumption of alcohol is associated with a decreased risk of some diseases (e.g. CHD, hypertensive heart disease and diabetes), which partly counter the modelled health benefits of abstaining from alcohol.*

**Figure 2: NCD deaths and YLDs that are averted or delayed between 2015 and 2025, for the combined risk factor target scenario.**



***NB. The small increase in COPD YLDs is due to a shift in the age distribution of the population, primarily as a result of reductions in CHD and stroke mortality, and does not reflect an increase in COPD rates***

**Table 3: Total NCD deaths and YLDs that are averted or delayed between 2015 and 2025, for each of the 25 by 25 targets.**

	30-69 years		70+ years	
	Men	Women	Men	Women
<b>Deaths</b>				
Obesity	12,000 (8,400 to 15,000)	4,100 (1,100 to 7,100)	44,000 (32,000 to 55,000)	23,000 (12,000 to 34,000)
Tobacco use	2,900 (2,700 to 3,000)	2,500 (2,500 to 2,600)	8,200 (7,800 to 8,600)	8,700 (8,400 to 8,900)
Diabetes	6,600 (5,400 to 7,900)	2,300 (1,800 to 2,700)	35,000 (28,000 to 42,000)	29,000 (23,000 to 35,000)
Raised blood pressure	3,000 (2,800 to 3,200)	1,200 (1,100 to 1,300)	14,000 (13,000 to 14,000)	11,000 (11,000 to 12,000)
Salt intake	5,600 (5,400 to 5,800)	1,500 (1,400 to 1,600)	25,000 (24,000 to 26,000)	16,000 (15,000 to 16,000)
Harmful alcohol use	3,100 (1,900 to 4,400)	1,300 (750 to 1,800)	7,700 (5,000 to 10,000)	4,000 (800 to 7,300)
Physical inactivity	560 (400 to 720)	170 (130 to 210)	2,700 (2,000 to 3,400)	2,200 (1,600 to 2,800)
Combined scenario	31,000 (25,000 to 36,000)	9,700 (6,700 to 13,000)	130,000 (110,000 to 140,000)	79,000 (63,000 to 94,000)
<b>YLDs</b>				
Obesity	72,000 (60,000 to 84,000)	46,000 (35,000 to 57,000)	140,000 (120,000 to 160,000)	90,000 (63,000 to 120,000)
Tobacco use	11,000 (11,000 to 11,000)	14,000 (13,000 to 14,000)	14,000 (14,000 to 14,000)	20,000 (20,000 to 21,000)
Diabetes	170,000 (170,000 to 170,000)	140,000 (140,000 to 140,000)	300,000 (290,000 to 310,000)	260,000 (260,000 to 270,000)
Raised blood pressure	9,400 (8,700 to 10,000)	6,200 (5,600 to 6,900)	22,000 (21,000 to 23,000)	15,000 (14,000 to 16,000)
Salt intake	17,000 (16,000 to 18,000)	8,500 (8,100 to 8,800)	38,000 (36,000 to 40,000)	21,000 (20,000 to 21,000)
Harmful alcohol use	3,800 (-12,000 to 20,000)	-230 (-5,900 to 5,400)	9,600 (-17,000 to 36,000)	2,000 (-8,100 to 12,000)
Physical inactivity	3,800 (3,300 to 4,300)	3,300 (2,900 to 3,700)	8,300 (7,100 to 9,500)	7,800 (6,800 to 8,900)
Combined scenario	220,000 (200,000 to 240,000)	170,000 (160,000 to 180,000)	410,000 (370,000 to 450,000)	320,000 (300,000 to 340,000)

*NB. Values are mean and 95% uncertainty intervals. The Technical Appendix presents numbers further broken down by disease (e.g. type of cancer).*

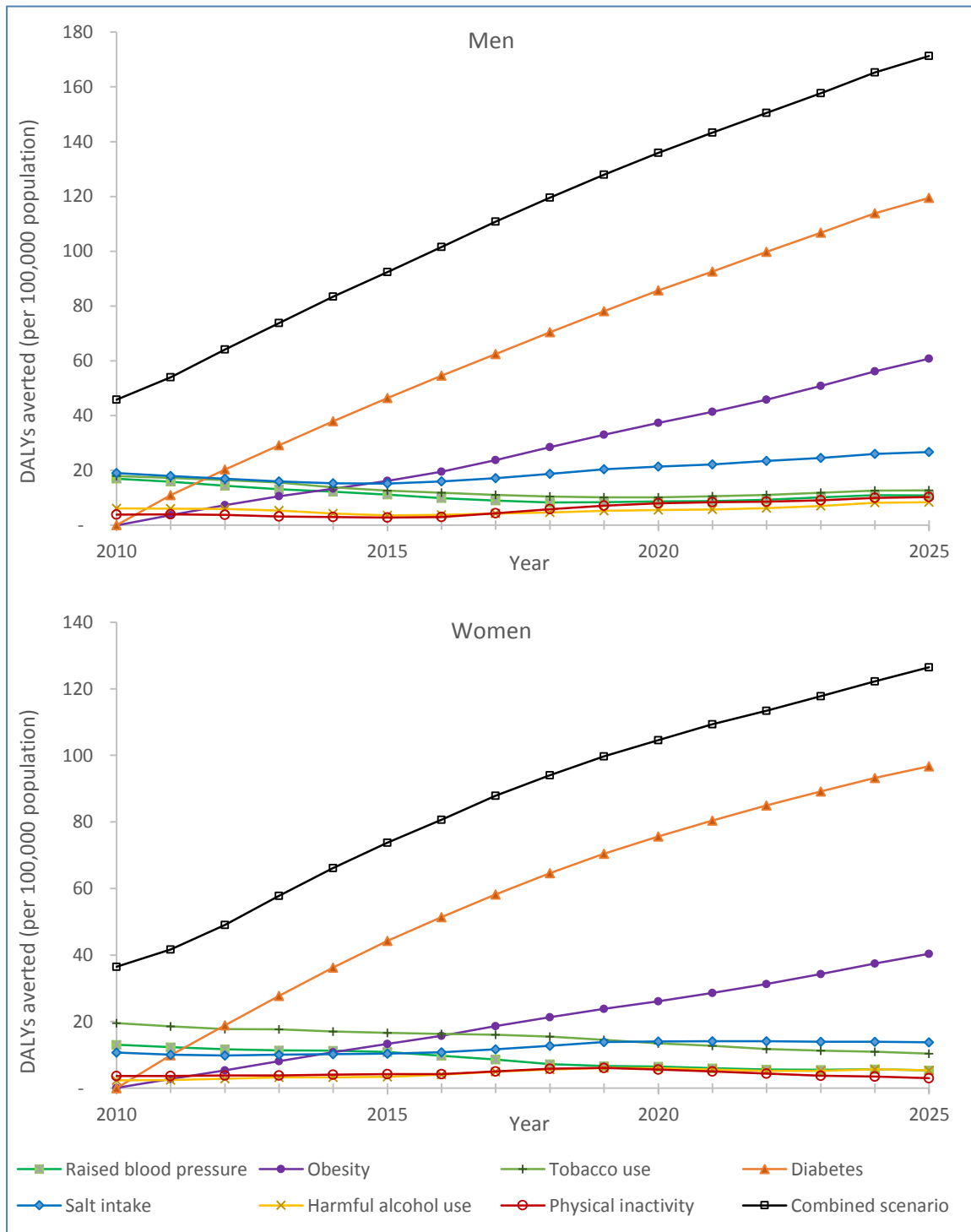
Although reductions in mortality as a result of achievement of the 25 by 25 targets were dominated by cardiovascular conditions (CHD and stroke), reductions in disability had a different pattern (Figure 2 and Table 3). The largest contributors to reductions in disability (measures as years of life lost in disability – YLDs) by order were diabetes, depression, stroke, dementia and CHD for women, and diabetes, stroke, CHD, dementia and depression for men. Due mainly to the large burden of diabetes in younger age groups, the disparity between reductions in disability due to the 25 by 25 targets in 30-69 year olds and 70+ year olds was much smaller than for mortality. The 25 by 25 target to halt the increase in diabetes made the biggest contribution to reductions in disability, contributing nearly three quarters of the improvements for men and over 80% for women.

For most of the risk factors, the biggest impact on health outcomes was achieved in the initial year of the modelling (2010), and the remainder of the simulation period showed similar or diminishing impact on health burdens (Figure 3). For example, the reduction of female smoking by 30% reduces the total disease burden by 20 DALYs averted per 100,000 in 2010 (DALYs are a combination of early mortality and years lived with disability) to 15 DALYs averted per 100,000 in 2025. However, this is not the case for diabetes and obesity, where the impact on health burden of meeting the 25 by 25 targets increases year on year between 2010 and 2025. This is because of the nature of the targets. For blood pressure, smoking, salt, alcohol consumption and physical inactivity the targets are set as a relative reduction in the prevalence of a risk factor that is currently reducing already. For obesity and diabetes, the target is for an absolute reduction in the prevalence of risk factors that are currently increasing.

The difference in the size of the impact for each of the risk factor targets is due to a combination of the following: the size of the relationship between the risk factor and NCDs; the current trend in the risk factor; the ambition of the target. Obesity is strongly linked with many NCDs, rates are currently increasing in the UK, and halting the rise in obesity is an ambitious target that would result in wide divergences between the business-as-usual and target scenarios by 2025, so it is unsurprising that this target has the biggest impact on NCD burden in our analyses. In contrast, physical activity is strongly related to many NCDs, but rates of physical inactivity are currently falling in the UK, and achieving the WHO target would not lead to wide differences in physical activity levels by 2025 (for example, by 2025 our projections suggest 28% of men aged 36-55 will be inactive, which would reduce to 25% if the WHO target is achieved. In comparison, the obesity target would keep the prevalence of obesity at 31% compared to 45% in the business-as-usual scenario). Therefore, comparisons of the relative size of the impact of achieving the WHO risk factor targets should not be taken as an indication of the relative importance of tackling each risk factor.

For complete results by age, sex, risk factor and disease, see the Technical Appendix.

Figure 3: DALYs averted by the 25 by 25 targets between 2010 and 2025.



## **Policy review**

The results of the policy review are presented below, subdivided by the four behavioural risk factors: poor diet, physical inactivity, smoking and alcohol consumption. For each risk factor, the three interventions on the PROMISE shortlist (see Box 2) are discussed in turn. For four of the interventions, we have also modelled the potential impact of implementation using the models described above. These interventions are: reformulation of packaged food, including portion size control; behaviour change advice for physical inactivity, delivered through primary care; further restriction of alcohol marketing; and maintaining increases of tax on tobacco at above inflation rates. For each of these interventions detailed methods of the modelling are described in the Technical Appendix, and results are presented in this section. All of the sources of evidence used to inform the policy review are provided in a reference list in the Technical Appendix.

## **POOR DIET**

The House of Commons Health Select Committee report 'Impact of physical activity and diet on health', published in 2015, concludes that policy makers should consider actions relating to each of the following three intervention options chosen to be taken forward for further consideration by the Richmond Group.

### **Sugar sweetened beverage tax**

In their briefing paper 'Using price policies to promote healthier diets', the European Regional Office of the WHO provides a summary of the rationale and evidence around food pricing strategies and highlights the experiences of several countries where some form of food-based tax has been introduced. It concludes that "the evidence is largely consistent with the theory, and suggests that price policies have the potential to influence consumer purchasing in the desired direction" and that "taxes on sugar sweetened beverages and targeted subsidies on fruit and vegetables emerge as the policy options with the greatest potential to induce positive changes in consumption". Our scoping review supports these conclusions with the caveat that the existing evidence base is largely drawn from simulation or modelling studies which limits our understanding about the impact of food pricing strategies in 'real' life. There is still much to understand about how such taxation systems might be implemented and much to learn about how different population groups might receive and respond to such policy initiatives.

Andreyeva et al (2010)<sup>28</sup> report the results of their systematic review of research on the price elasticity of demand for food. This review included 160 US studies (sourced until 2007) and aimed to estimate the effect of price changes on the primary demand for a range of food categories employed by the Dietary Guidelines for Americans. They report that food prices are relatively inelastic compared with other commodities but that, according to their estimates, food eaten away from home, soft drinks and juice are most likely to be responsive to changes in price compared with other food categories like eggs or fats and oils. In this review, elasticity estimates for soft drinks remained

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<sup>28</sup> Andreyeva T, Long MW, Brownell KD. The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food. *Am J Public Health*, 2012;100(2):216-222.

relatively stable even when the definition of 'soft drink' was changed to incorporate different drink categories (e.g. carbonated soft drinks, fruit juices, soda, non-alcoholic beverages). There was no information available on cross-price elasticity for soft drinks (where consumers substitute one product for another). Limited data availability meant that Andreyeva et al were unable to estimate the differential impact of prices changes on consumers with varying incomes, or across differences in age, educational status, culture or ethnicity. The authors conclude that "soft drinks offer a possible target for public health tax policies" but also warn that the evidence base would be strengthened by a greater understanding of real-life changes in consumer behaviour as price changes occur rather than estimating potential public health benefits.

Thow et al (2010)<sup>29</sup> included 24 peer-reviewed and grey-literature studies in their systematic review of the effect of food taxes and subsidies on diet, body weight and health. The literature included was published between 2000-2009, with most studies published from 2006, and 23 studies originating in high income countries, mostly in the US. They conclude that taxes and subsidies have the potential to impact on public health, especially when the price changes proposed are substantial. Mixed results were found in the 10 included studies which addressed soft drinks taxes. The authors also noted inconsistent findings around the regressive nature of food taxes and point to an over-reliance on modelling studies, which they argue are based on assumptions and subject to data limitations. Thow et al call for improvements in the range and quality of studies on food taxes and subsidies to supplement the "inadequate evidence" available for policy makers.

Eyles et al (2012)<sup>30</sup> undertook a systematic review of simulation studies of food pricing strategies to ascertain how food price changes might impact on food consumption, health and disease outcomes and on different income groups with a population. They included 32 studies sourced from 1990-2011 (of which 19 were peer-reviewed papers and 13 other types of report). They report findings that point towards a health benefit in the included studies which assessed the impact of carbonated soft drinks taxes. They also suggest that, in modelled relationships, larger price increases provide a correspondingly greater reduction in consumption. The authors updated their literature search to include studies published after they had completed their systematic review (until October 2012) and concluded that the additional literature they found on sugar-sweetened beverages supported their review findings. The review found that most of the included studies estimated a positive absolute impact on lower income population groups but the authors also noted that the majority of studies which they included were of low/medium methodological quality. Eyles et al conclude that, based on modelling studies, the introduction of carbonated soft drinks taxes would be associated with positive dietary change. They also call for improvements in the quality of simulation studies; highlight the need for more information about the impact of food pricing strategies on lower income groups; for evaluation of 'natural experiments', where soft drinks taxes are introduced in the 'real' world which would build an understanding of the practical implications of the introduction of a food tax.

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<sup>29</sup> Thow AM, Jan S, Leeder S, Swinburn B. The effect of fiscal policy on diet, obesity and chronic disease: a systematic review. *Bull World Health Organ*, 2010;88(8):609-614.

<sup>30</sup> Eyles H, Ni Mhurchu C, Nghiem N, Blakely T. Food pricing strategies, population diets, and non-communicable disease: a systematic review of simulation studies. *PLoS Med*, 2012;9(12):e1001353.

Powell et al (2013)<sup>31</sup> set out to assess the potential effectiveness of food and beverage taxation for improving public health. They included 41 US studies (20 studies on the effects of price on consumption patterns and 21 studies linking effects of price on body weight) in their systematic review, sourced from 2007 – March 2012. Their findings support earlier review conclusions and suggest that sugar-sweetened beverages may be more price sensitive than previously considered. The authors found limited or no association between existing soda taxes and weight outcomes (which could be explained by the nature of the evidence they are able to examine), although they suggest that this may be due to the small level of taxation and that such taxes are typically applied equally to healthier and less healthy product choices. Powell et al call for future studies to refine their methods to disaggregate sugar-sweetened beverages from ‘diet’ varieties and for further work on the mechanisms for applying such taxes.

### **Reformulation of packaged food, including portion size control**

Our scoping review suggests that there is evidence to support encouraging reformulation of food products to improve their nutritional profiles, although there remains much to learn about the most effective type of approaches, or combinations of approaches, which might be needed to achieve this.

In 2010, NICE published public health guidance on the prevention of cardiovascular disease<sup>32</sup>. Between September 2008 and July 2009, the PDG charged with producing the guidance considered evidence of effectiveness, expert reports and cost effectiveness to generate a comprehensive set of recommendations based on the best available evidence. This included policy goals to reduce population-level consumption of salt and saturated fat and to protect the population from the harmful effects of industrially-produced trans fatty acids (IPTFAs). NICE suggest the following evidence-based measures, amongst others, which would favourably impact on population levels of salt, saturated fat and IPTFAs:

- Ensure food producers and caterers continue to reduce the salt content of commonly consumed foods (including bread, meat products, cheese, soups and breakfast cereals). This can be achieved by progressively changing recipes, products and manufacturing and production methods.
- Encourage manufacturers, caterers and producers to reduce substantially the amount of saturated fat in all food products. If necessary, consider supportive legislation.
- Create favourable conditions for industry and agriculture to produce dairy products for human consumption that are low in saturated fat.
- Eliminate the use of IPTFAs for human consumption.
- In line with other EU countries, introduce legislation to ensure that IPTFA levels do not exceed 2% in the fats and oils used in food manufacturing and cooking.
- Create and sustain local and national conditions which support a reduction in the amount of IPTFAs in foods, while ensuring levels of saturated fat are not increased. Encourage the use

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<sup>31</sup> Powell L, Chriqui J, Khan T, Wada R, Chaloupka F. Assessing the potential effectiveness of food and beverage taxes and subsidies for improving public health: a systematic review of prices, demand and body weight outcomes. *Obesity Reviews*, 2013;14:110–128.

<sup>32</sup> NICE. *Prevention of Cardiovascular Disease. NICE public health guideline 25*. NICE: London, 2010.



of vegetable oils high in polyunsaturated and monounsaturated fatty acids to replace oils containing IPTFAs.

- Develop UK-validated guidelines and information for the food service sector and local government on removing IPTFAs from the food preparation process.

In their assessment of the public health nutrition policies of 30 European countries, Lloyd-Williams et al (2014)<sup>33</sup> report that, at the time of their study, 13 countries had mandatory maximum salt content levels in foods; four countries had trans-fat bans, two countries had legislation in place in relation to sugar, one country had mandatory regulation around fatty and sugary foods and one country had regulation affecting fruit and vegetables. The authors report that participants in their study perceived mandatory reformulation of food products to be an effective mechanism for improving public health nutrition. Voluntary reformulation was more commonly reported than mandatory reformulation (in 25 of the 30 countries), most commonly for salt, and less frequently in relation to the fat and sugar content of some foods. Lloyd-Williams et al suggest that voluntary reformulation has had a modest and variable impact.

Webster *et al* (2014)<sup>34</sup> provide a global overview of national initiatives to encourage the food industry to reduce salt. They report that 80% of countries with a national salt reduction strategy are working with the food industry and suggest that almost all countries which have achieved progress have done so by setting a target for salt levels in foods. They consider the debate about whether success can be attributed to voluntary or mandatory action, suggesting that a combination of measures such as strong leadership, requirements for consumer labelling, robust monitoring and NGO pressure can re-enforce voluntary action to reformulate.

Downs *et al* (2013)<sup>35</sup> report a systematic review of 26 studies (sourced from 2005-2012) which examined various policy actions to reduce dietary trans-fat consumption, including reformulation. They find positive findings for any policy intervention aimed at trans-fat reduction, although the degree of success varied across product category, and suggest that product reformulation has led to an improvement in the fatty acid profile of foods, at least in high-income countries.

The most convincing evidence to date about the role of portion size in food selection comes from a systematic review published by Hollands *et al* in 2015<sup>36</sup>. This Cochrane review included 72 studies published up to July 2013, 96% of which manipulated food products, either by portion size (35 studies), package size or tableware size/shape. The authors conclude that *“people consistently consume more food and drink when offered larger-sized portions, packages or tableware than when offered smaller-sized versions. This suggests that policies and practices that successfully reduce the*

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<sup>33</sup> Lloyd-Williams F, Bromley H, Orton L, Hawkes C, Taylor-Robinson D, O’Flaherty M, et al. Smorgasbord or symphony? Assessing public health nutrition policies across 30 European countries using a novel framework. *BMC Public Health*, 2014;14:1195.

<sup>34</sup> Webster J, Trieu K, Dunford E, Hawkes C. Target Salt 2025: A Global Overview of National Programs to Encourage the Food Industry to Reduce Salt in Foods. *Nutrients*, 2014;6(8):3274-3287.

<sup>35</sup> Downs SM, Thow AM, Leeder SR. The effectiveness of policies for reducing dietary trans fat: a systematic review of the evidence. *Bulletin of the World Health Organization*, 2013;91(4):262-269.

<sup>36</sup> Hollands GJ, Shemilt I, Marteau TM, Jebb SA, Lewis HB, Wei Y, et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. *Cochrane Database of Systematic Reviews* 2015, 9:CD011045. DOI: 10.1002/14651858.CD011045.pub2.

*size, availability and appeal of larger-sized portions, packages, individual units and tableware can contribute to meaningful reductions in the quantities of food (including non-alcoholic beverages) people select and consume in the immediate and short term.”* Hollands *et al* rated the overall quality of the evidence they reviewed as moderate and suggest that more needs to be known about longer-term impacts and in ‘real-life’ conditions where portion size is not likely to be so highly controlled as in many of the studies included in this review.

We modelled the impact of reformulating foods in England in order to reduce salt levels, sugar levels and portion sizes. For salt levels, we used salt targets for 2017 developed by the Food Standards Agency for 76 food categories<sup>37</sup>. For both sugar levels and portion size reduction we used examples of industry best practice identified by the UK Food Network Responsibility Deal<sup>38</sup>. We assumed that reformulation would be taken up by 39% of the food industry, following an expert consultation by Gillespie *et al* (2015)<sup>39</sup>. Full methods are provided in the Technical Appendix.

We estimated that food reformulation would result in 14,000 (2,500 to 25,000) deaths averted or delayed in men, and 12,000 (1,700 to 22,000) in women by 2025 (Figure 4 and Table 4). For both men and women, the majority of the deaths delayed or averted were from CHD or stroke, but there were also sizeable reductions in mortality from cirrhosis and cancer of the colorectum, liver, pancreas and kidney (due primarily to reductions in body weight). Food reformulation would also have a sizeable impact on disability, with over 32,000 years of life lived with disability from diabetes removed by reformulation.

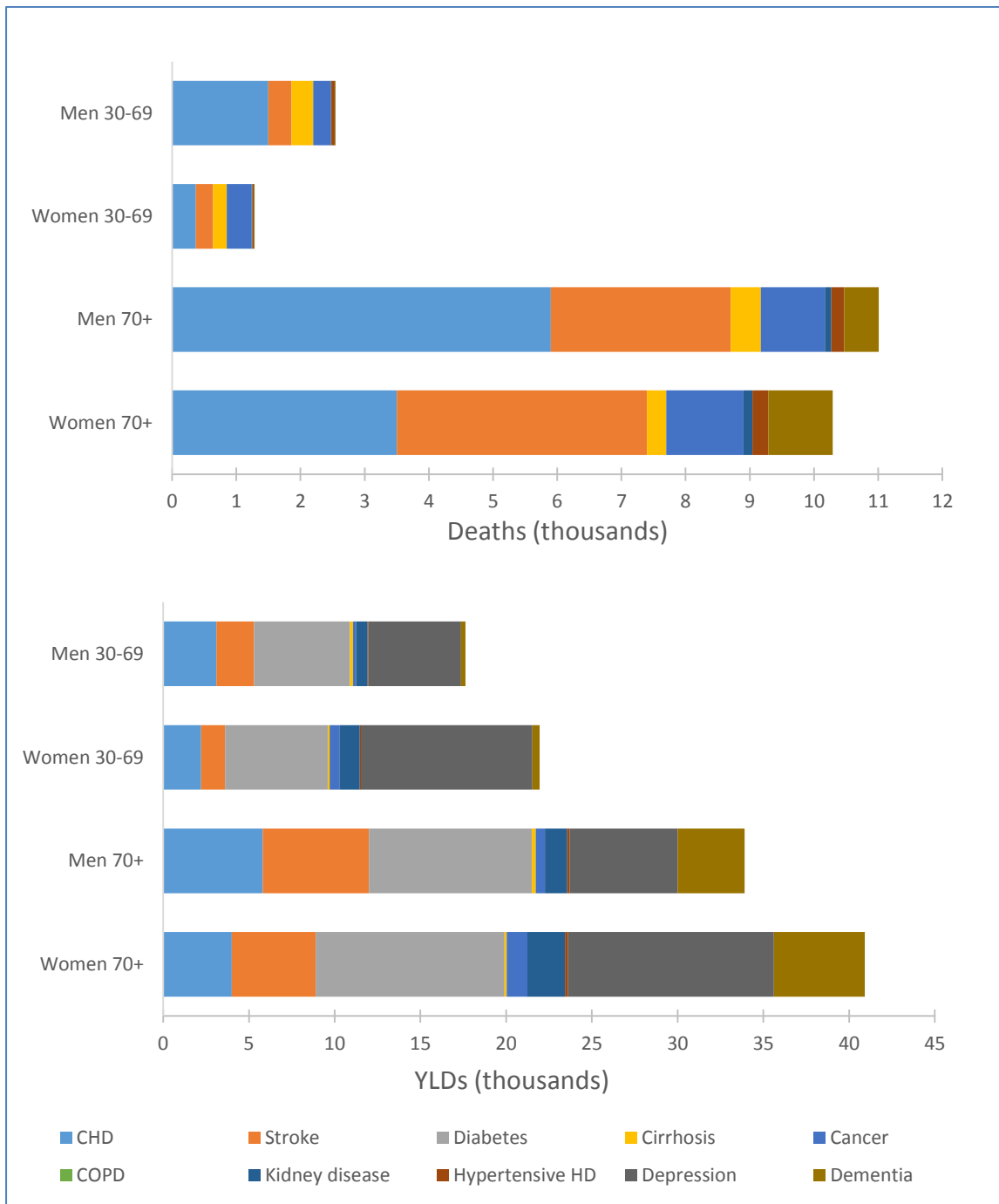
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<sup>37</sup> Food Standards Agency. *Salt reduction targets for 2017*. FSA: London, 2015.

<sup>38</sup> Department of Health. *Calorie reduction pledge development tool – using industry best practice examples*. DH: London, 2015.

<sup>39</sup> Gillespie D, Allen K, Guzman-Castillo M, Bandosz P, Moreira P, McGill R, *et al*. The Health Equity and Effectiveness of Policy Options to Reduce Dietary Salt Intake in England: Policy Forecast. *Plos One*, 2015;10(7):e0127927.

**Figure 4: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with food reformulation.**



**Table 4: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with food reformulation.**

	Deaths		YLDs	
	Men	Women	Men	Women
CHD	7,400 (1,200 to 14,000)	3,800 (570 to 7,100)	8,900 (2,600 to 15,000)	6,200 (2,900 to 9,400)
Stroke	3,200 (560 to 5,800)	4,200 (660 to 7,700)	8,400 (5,800 to 11,000)	6,300 (2,800 to 9,900)
Diabetes	56 (34 to 79)	36 (17 to 56)	15,000 (15,000 to 15,000)	17,000 (17,000 to 17,000)
Cirrhosis	810 (100 to 1,500)	510 (67 to 950)	410 (-300 to 1,100)	250 (-190 to 700)
Mouth cancer	-	-	-	-
Oesophagus cancer	-	-	-	-
Colorectal cancer	610 (120 to 1,100)	500 (62.0 to 930)	530 (39 to 1,000)	410 (-26 to 850)
Liver cancer	350 (30 to 670)	270 (17 to 520)	99 (-220 to 420)	64 (-190 to 310)
Pancreas cancer	150 (45 to 250)	150 (24 to 270)	11 (-93 to 110)	11 (-110 to 130)
Larynx cancer	-	-	-	-
Lung cancer	-	-	-	-
Breast cancer	-	620 (-180 to 1,400)	-	1,300 (480 to 2,100)
Cervix cancer	-	-	-	-
Kidney cancer	160 (-10 to 320)	110 (-13 to 230)	73 (-94 to 240)	44 (-75 to 160)
Bladder cancer	-	-	-	-
Stomach cancer	-	-	-	-
COPD	-	-	-	-
Kidney disease	110 (22 to 200)	150 (15 to 290)	1,900 (1,800 to 2,000)	3,400 (3,300 to 3,500)
Hypertensive HD	260 (42 to 470)	280 (28 to 520)	200 (-21 to 410)	240 (-10 to 490)
Depression	-	-	12,000 (12,000 to 12,000)	22,000 (22,000 to 22,000)
Dementia	550 (310 to 790)	1,000 (430 to 1,600)	4,200 (4,000 to 4,400)	5,700 (5,100 to 6,300)

*NB. Values are mean and 95% uncertainty intervals, rounded to two significant figures.*

### **Further restriction of unhealthy food marketing**

In 2010, the NICE public health guidance on the 'Prevention of Cardiovascular Disease' also made recommendations in relation to restrictions on food marketing aimed at children<sup>40</sup>. These included the following evidence-based measures:

- Ensure children and young people under 16 are protected from all forms of marketing, advertising and promotions (including product placements) which encourage an unhealthy diet.
- Extend TV advertising scheduling restrictions on food and drink high in fat, salt or sugar (as determined by the Food Standards Agency's nutrient profile) up to 9pm.
- Develop equivalent standards, supported by legislation, to restrict the marketing, advertising and promotion of food and drink high in fat, salt or sugar via all non-broadcast media. This includes manufacturers' websites, use of the Internet generally, mobile phones and other new technologies.
- Ensure restrictions for non-broadcast media on advertising, marketing and promotion of food and drink high in fat, salt or sugar are underpinned by the Food Standards Agency nutrient profiling system.

In a systematic review produced for the WHO, Cairns et al (2009)<sup>41</sup> identified 115 studies on the extent and nature of food promotion to children and 90 studies on its effects. They report that *"food promotion is the most prevalent marketing category targeting children and young people... the majority of foods and food products promoted are energy dense, high fat, sugar and/or high salt, and in sharp contrast to national and international dietary guidelines. Sugar-sweetened breakfast cereals, soft-drinks, confectionary and savoury snacks are the most frequently advertised categories, with fast-food promotion continuing to gain marketing share."* The authors suggest that while television advertising remains the most common form of food promotion, new mass media approaches via websites and mobile telephones seem to be gaining in popularity, and what evidence exists suggests that these new approaches are effective forms of food promotion. Cairns et al conclude that there is modest, consistent evidence of a causal link between food promotion and determinants of behaviour (like nutrition knowledge and food preferences), food behaviours (consumption patterns) and diet-related health outcomes.

## **PHYSICAL INACTIVITY**

### **Redesign urban environments to prioritise walking and cycling**

Redesigning urban or built environments to prioritise walking and cycling was the central focus of NICE's PH41 review<sup>42</sup>. When updated in 2014, the evidence statements remained unchanged, and the best available evidence was used to state that cycling demonstration towns (multi-component interventions to increase cycling in six towns) are effective in increasing population levels of cycling

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<sup>40</sup> NICE. *Prevention of Cardiovascular Disease. NICE public health guideline 25*. NICE: London, 2010.

<sup>41</sup> Cairns G, Angus K, Hastings G. *The extent, nature and effects of food promotion to children: a review of the evidence to December 2008*. World Health Organization: Geneva, 2009.

<sup>42</sup> NICE. *Walking and cycling: local measures to promote walking and cycling as forms of travel or recreation. NICE public health guidelines 41*. NICE: London, 2012.

for active travel in the general population up to 10 years post intervention. Our scoping review agrees with this position and is also supplemented by some economic modelling of examples where infrastructure has been altered and evaluated with cost benefits and cost utility changes in walking and cycling. Although some of this modelling is based on a number of heroic assumptions such approaches were cost effective and applicable to adoption in the UK.

Implementing this evidence would see a range of different actions combined together. There were different levels of evidence to support these actions however NICE felt that their combined actions would be preferable than separate implementation. Actions would include:

- Implement town-wide programmes to promote cycling for both transport and recreational purposes. These could include cycle hire schemes, car-free events or days, providing information such as maps and route signing, activities and campaigns that emphasise the benefits of cycling, fun rides, and others.
- Ensure walking routes are integrated with accessible public transport links to support longer journeys. Signage should give details of the distance and/or walking time, in both directions, between public transport facilities and key destinations.
- Develop and implement school travel plans that encourage children to walk or cycle all or part of the way to school, including children with limited mobility. Pupils should be involved in the development and implementation of these plans.
- Ensure walking and cycling are considered alongside other interventions, when working to achieve specific health outcomes in relation to the local population (such as a reduction in the risk of cardiovascular disease, cancer, obesity and diabetes, or the promotion of mental wellbeing).

The review by Hansen et al (2015)<sup>43</sup> warns that most of the research studies relating to the environment's impact on physical activity have not been performed with rural populations or in rural contexts. The issue relates to the different patterns of environmental exposure between urban and rural communities. There will be fewer parks, playing fields, cycle and walking infrastructure, higher traffic speeds, less networked public transport and a greater reliance on motorised transport. The authors also warn that despite having more immediate access to natural resources in a rural area, the lack of infrastructure to access or encourage use also limits its potential use.

A recent review of systematic reviews of the relationship of the environment and physical activity stated that many of the reviews of effectiveness in this field demonstrate methodological limitations that might lead to inaccurate portrayals of the evidence<sup>44</sup>. The authors stress the importance of taking an ecological or multi-variable pathway between the environment and specific population groups, as these differ between environments and people. Ecological models postulate that environmental attributes may interact with sociodemographic characteristics in influencing one's behaviour, which may lead to differential associations between environments and physical activity among different population subgroups. The ability to respond to an environmental intervention may be as limited as healthy volunteers responding to traditional offers of health screening. The authors

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<sup>43</sup> Hansen AY, Umstadtd Meyer MR, Lenardson JD, Hartley D. Built Environments and Active Living in Rural and Remote Areas: a Review of the Literature. *Curr Obes Rep*,2015;4(4):484-493.

<sup>44</sup> Gebel K, Ding D, Foster C, Bauman AE, Sallis JF. Improving current practice in reviews of the built environment and physical activity. *Sports Medicine*, 2015;45(3):297-302.

conclude with identical calls from NICE for research to identify the differential impacts of environmental interventions across and within population groups.

### **Support for community groups that encourage physical activity**

Support for community groups that encourage physical activity can include a range of actions by a range of different community based organisations. Reviews by NICE have supported the evidence of effectiveness for community led walking groups that have used pedometers, as part of their intervention strategies<sup>45</sup>. The evidence on community pedometer interventions to increase walking is only partially applicable to the UK. Three studies were conducted in the UK, with the majority in the USA, Australian, Canada, and Japan. The evidence to support individual-level change in community-based walking group interventions to increase walking is less consistent. There was consistent evidence that the provision of clubs to promote walking were only partially successful at reaching men and were generally poor at sustaining walking beyond 12 weeks duration. Recent primary studies of Football Fans in Training, physical activity interventions based in local football clubs, have demonstrated long term and sustained behaviour change, showing the context and framing of an offer to be active must be seen as something that “people like me would do”<sup>46</sup> (Hunt et al, 2014). The location and style of delivery of early sessions fostered team spirit; men appreciated being with others 'like them' and the opportunity to undertake physical activity and weight management in circumstances that enhanced physical and symbolic proximity to something they valued highly, the football club. This data has not been assimilated within review level evidence as yet.

A meta-analysis of group based approaches to promoting walking (19 studies, 4 572 participants) by Kassavou et al (2013)<sup>47</sup> found moderate effects on physical activity, however less than half of the studies included in this review were randomised controlled trials (RCTs). The authors also report that no significant differences were found between studies delivered by professionals and those delivered by lay people. They state one of the benefits of group interventions being to target more people than individually based interventions, so there are economies of scale and implementation by devoting resources to designing and implementing interventions to promote walking in groups. Again the issue of reach and recruitment appears largely ignored by this body of evidence.

### **Behaviour change advice service, delivered through primary care**

The effectiveness of promotion of physical activity in primary care has received much research attention since the mid-1990s. The effectiveness of UK RCTs has tended to be low compared to other studies performed in the USA or Australia<sup>48</sup>. The quality of studies has been poor with short

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<sup>45</sup> NICE. *Walking and cycling: local measures to promote walking and cycling as forms of travel or recreation. NICE public health guidelines 41*. NICE: London, 2012.

<sup>46</sup> Hunt K, Gray CM, Maclean A, Smillie S, Bunn C, Wyke S. Do weight management programmes delivered at professional football clubs attract and engage high risk men? A mixed-methods study. *BMC Public Health*, 2014;21:14-50.

<sup>47</sup> Kassavou A, Turner A, French DP. Do interventions to promote walking in groups increase physical activity? A meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 2013;10:18.

<sup>48</sup> Richards J, Thorogood M, Hillsdon M, Foster C. Face-to-face interventions for promoting physical activity. *Cochrane Database of Systematic Reviews*, 2013;9:CD010392.

term effects in changing behaviour declining over time. Despite this evidence, UK policy makers and practitioners appear committed to seeing the promotion of physical activity delivered within primary care. The challenges for the implementation of any behaviour change service remains who will deliver this approach, who will be targeted and who will pay?

The strategies or components of an intervention were identified by NICE's review<sup>49</sup>. The guideline aimed to support routine provision of brief advice on physical activity in primary care practice. The term 'brief advice' used in this guidance was defined to mean verbal advice, discussion, negotiation or encouragement, with or without written or other support or follow-up. It can vary from basic advice to a more extended, individually focused discussion. Typically strategies suggested for such an intervention included:

- identifying adults who are inactive
- delivering and following up on brief advice
- incorporating brief advice in commissioning
- systems to support brief advice
- information and training to support brief advice.

The challenge of implementation for primary care staff was addressed in the NICE guidance with two key issues, systems and training. Systems to support brief advice included:

- Ensure systems such as Read Codes are being used to identify opportunities to assess people's physical activity levels and deliver brief advice.
- Ensure resources (for example, standard documents and forms) and systems are available to assess, record and follow up on the provision of brief advice.
- Ensure information about local opportunities to be active (including non-sporting activities) is available and up to date. This could include online maps and route finding for walking or adapted cycling.

Training needs included to provide information and training for primary care practitioners and included:

- how physical activity promotion fits within their remit and how it can help prevent and manage a range of health conditions
- the definition of physical activity: what constitutes moderate and vigorous physical activity, and what intensity, duration and frequency of physical activity is needed to achieve the UK physical activity guidelines
- groups more likely to be inactive
- misconceptions about who needs to increase their physical activity (based, for example, on visual cues such as body weight)
- how to undertake physical activity assessments
- local opportunities for physical activity
- the needs of specific groups, such as people with disabilities, including local opportunities for them to be physically active
- delivery of brief advice including, for example, the skills to motivate people to change

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<sup>49</sup> NICE. *Physical activity: brief advice for adults in primary care. Public health guidance 44*. NICE: London, 2013.



The call for primary care based counselling is aspirational according to the effectiveness evidence and is, at present, without effective pathways for implementation.

We modelled the impact of brief advice for physical activity being delivered in primary care as defined by the NICE guidance<sup>50</sup>, with standardised measurement of physical activity included as a Quality Outcomes Framework (QOF) outcome. We assumed brief advice would be delivered by 67% of GP practices, after a meta-analysis of UK surveys of GPs and practice nurses about willingness to deliver brief advice about physical activity (see Technical Appendix). We estimated the effect size of the advice using a meta-analysis of studies that included at least six months of follow-up, identified from the NICE review that supported the guidance<sup>51</sup>. Full details of the methods can be found in the Technical Appendix.

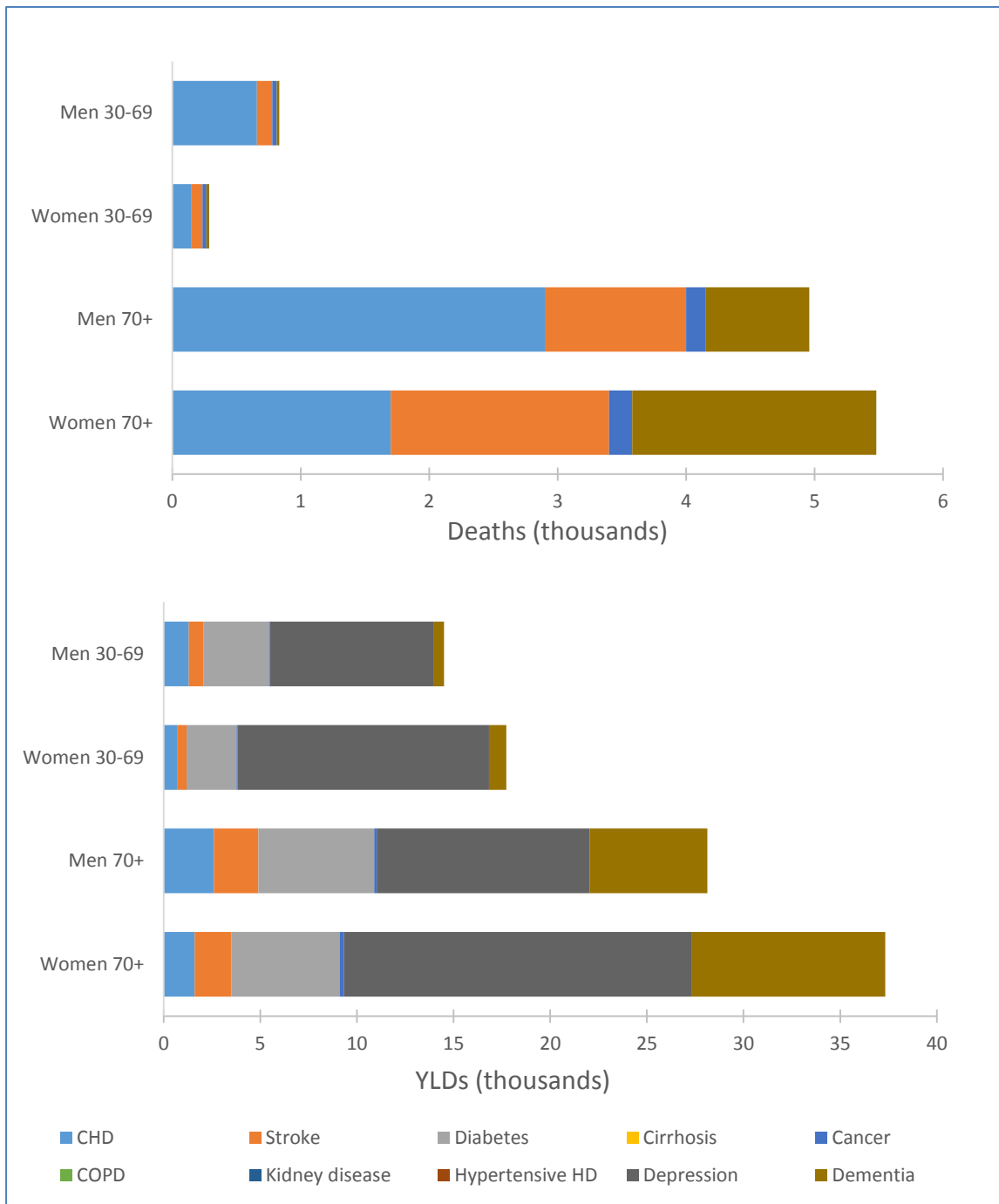
We estimated that the intervention would lead to 5,800 (2,800 to 8,800) deaths averted or delayed in men, and a further 5,800 (2,300 to 9,400) in women up to 2025. The vast majority of these averted or delayed deaths would be from either CHD or stroke, with a small contribution from colorectal and breast cancers. The intervention would also have a substantial impact on disability, particularly from diabetes with around 17,000 years of life lost to disability averted by 2025 (Figure 5 and Table 5).

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<sup>50</sup> *ibid.*

<sup>51</sup> Campbell F, Blank L, Messina J, Day M, Buckley Woods H, Payne N, Goyder E, Armitage C. *Physical activity: brief advice for adults in primary care*. ScHARR: Sheffield, 2012.

**Figure 5: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with physical activity behaviour change.**



**Table 5: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with physical activity behaviour change.**

	Deaths		YLDs	
	Men	Women	Men	Women
CHD	3,500 (1,700 to 5,300)	1,900 (850 to 2,900)	3,900 (2,100 to 5,700)	2,300 (1,300 to 3,400)
Stroke	1,200 (650 to 1,800)	1,800 (820 to 2,700)	3,100 (2,500 to 3,700)	2,400 (1,400 to 3,400)
Diabetes	24 (10 to 38)	18.0 (15 to 21)	9,400 (9,400 to 9,400)	8,300 (8,300 to 8,300)
Cirrhosis	-	-	-	-
Mouth cancer	-	-	-	-
Oesophagus cancer	-	-	-	-
Colorectal cancer	180 (130 to 230)	94 (56 to 130)	160 (120 to 210)	70 (32 to 110)
Liver cancer	-	-	-	-
Pancreas cancer	-	-	-	-
Larynx cancer	-	-	-	-
Lung cancer	-	-	-	-
Breast cancer	-	110 (55 to 170)	-	210 (160 to 270)
Cervix cancer	-	-	-	-
Kidney cancer	-	-	-	-
Bladder cancer	-	-	-	-
Stomach cancer	-	-	-	-
COPD	-	-	-	-
Kidney disease	-	-	-	-
Hypertensive HD	-	-	-	-
Depression	-	-	20,000 (20,000 to 20,000)	31,000 (31,000 to 31,000)
Dementia	830 (290 to 1,400)	1,900 (480 to 3,400)	6,600 (6,100 to 7,100)	11,000 (9,700 to 13,000)

*NB. Values are mean and 95% uncertainty intervals, rounded to two significant figures.*

## SMOKING

In the report *Smoking Still Kills*<sup>52</sup>, Action on Smoking and Health (ASH) propose a target to reduce adult smoking prevalence to no more than 5% in all socio-economic groups, by 2035. To support this goal, the ASH report recommends a series of actions, including the following three intervention options, shortlisted by the PROMISE study.

### **Maintain increases of tax on tobacco at above inflation rates**

Wilson et al (2012)<sup>53</sup> report the findings from a review which included 35 studies involving taxation and smoking prevalence. They conclude that there is a strong independent effect of price on smoking prevalence and found evidence, consistent with previous studies, to suggest that younger people are more price-sensitive than older smokers.

Chaloupka et al (2011)<sup>54</sup> report the findings of a review undertaken for the International Agency for Research on Cancer, which evaluated evidence on the effects of tax and price policies to prevent and reduce tobacco use. They conclude that there is 'sufficient' evidence (author defined) linking the effectiveness of increased tobacco taxation and prices with reductions in overall tobacco consumption and in prevalence of tobacco use. The findings support the use of "relatively simple tobacco excise tax structures ...that include regular tax increases that outpace growth in general price levels and incomes".

Amos et al (2011)<sup>55</sup> undertook a review of evidence on action to reduce socio-economic inequalities in smoking as part of a wider review of inequalities in health and tobacco control. They included 10 studies (2 reviews and 8 primary studies, sourced until September 2010) relating to the impact of price on smoking inequalities and conclude that there is strong evidence that increases in price reduce socioeconomic inequalities in smoking, at least in high income countries. An updated version of this review<sup>56</sup> reports the findings of 27 studies (sourced until January 2013) examining the impact of tax/price increases on inequalities and broadly confirms the conclusions of the earlier review.

Gilmore et al (2013)<sup>57</sup> reviewed a decade (1999-2009) of brand segmentation literature to assess whether the pricing strategies used by the tobacco industry undermine tobacco tax policy in the UK. They conclude that by maintaining the price of ultra-low price brands (by not passing on tax increases in full to the consumer) industry pricing strategies encourage smokers to switch to a cheaper brand (down trading) and that this may contribute to smoking-related inequalities.

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<sup>52</sup> ASH. *Smoking Still Kills: Protecting children, reducing inequalities*. ASH: London, 2015

<sup>53</sup> Wilson LM, Avila Tang E, Chander G, Hutton HE, Odelola OA, Elf JL, et al. Impact of Tobacco Control Interventions on Smoking Initiation, Cessation, and Prevalence: A Systematic Review. *Journal of Environmental and Public Health*, 2012;961724.

<sup>54</sup> Chaloupka FJ, Straif K, Leon ME. Effectiveness of tax and price policies in tobacco control. *Tobacco Control*, 2011;20:235-238.

<sup>55</sup> Amos A, Bauld L, Clifford D, Fidler J, Hill S, Hiscock R, et al. *Tobacco Control, Inequalities in Health and Action at a Local Level*. Public Health Research Consortium: York, 2011.

<sup>56</sup> Brown T, Platt S, Amos A. Equity impact of population-level interventions and policies to reduce smoking in adults: a systematic review. *Drug and Alcohol Dependence*, 2014;138:7-16.

<sup>57</sup> Gilmore AB, Tavakoly B, Taylor G, Reed H. Understanding tobacco industry pricing strategy and whether it undermines tobacco tax policy: the example of the UK cigarette market. *Addiction*, 2013;108:1317-1326.

ASH<sup>58</sup> recommends the following actions as part of an overall strategy to reduce the affordability of tobacco:

- Increase the tax escalator on tobacco products to 5 per cent above the level of inflation.
- Adjust the current national tax regime to raise the price of the cheapest cigarettes and prevent down-trading

We modelled the impact of increasing the tax on tobacco products at 5 per cent above the level of inflation up to 2025. We used estimates of price sensitivity to tobacco products from a study from the International Agency for Research on Cancer<sup>59</sup>. We found that the intervention would result in 1,500 (1,300 to 1,700) deaths averted or delayed in men, and a further 950 (860 to 1,100) in women up to 2025. The main contributors to this reduced mortality were cancers of the lung, oesophagus, liver, pancreas, bladder and stomach. The intervention would also have a substantial impact on disability, averting 11,000 (11,000 to 12,000) years of life with disability in men and 14,000 (14,000 to 14,000) in women (NB: small uncertainty ranges are obscured here due to rounding). The main contributor to reduce disability is COPD, responsible for over half of the reduction in disability for both men and women (Figure 6 and Table 6).

Whilst the results for this intervention are more modest than those for other interventions modelled here, it is worthwhile remembering that the size of the proposed intervention is very small. The BAU scenario, which provides the projected health outcomes against the intervention scenarios are compared, assumes that tax on cigarettes will be increased at a rate of 2% per year above inflation as that has been an approximation of UK Government policy since 2009<sup>60</sup>. Therefore, in our analyses the intervention only accounts for an extra 3% increase in tax per annum, which has a modest impact on the overall price of cigarettes over this time.

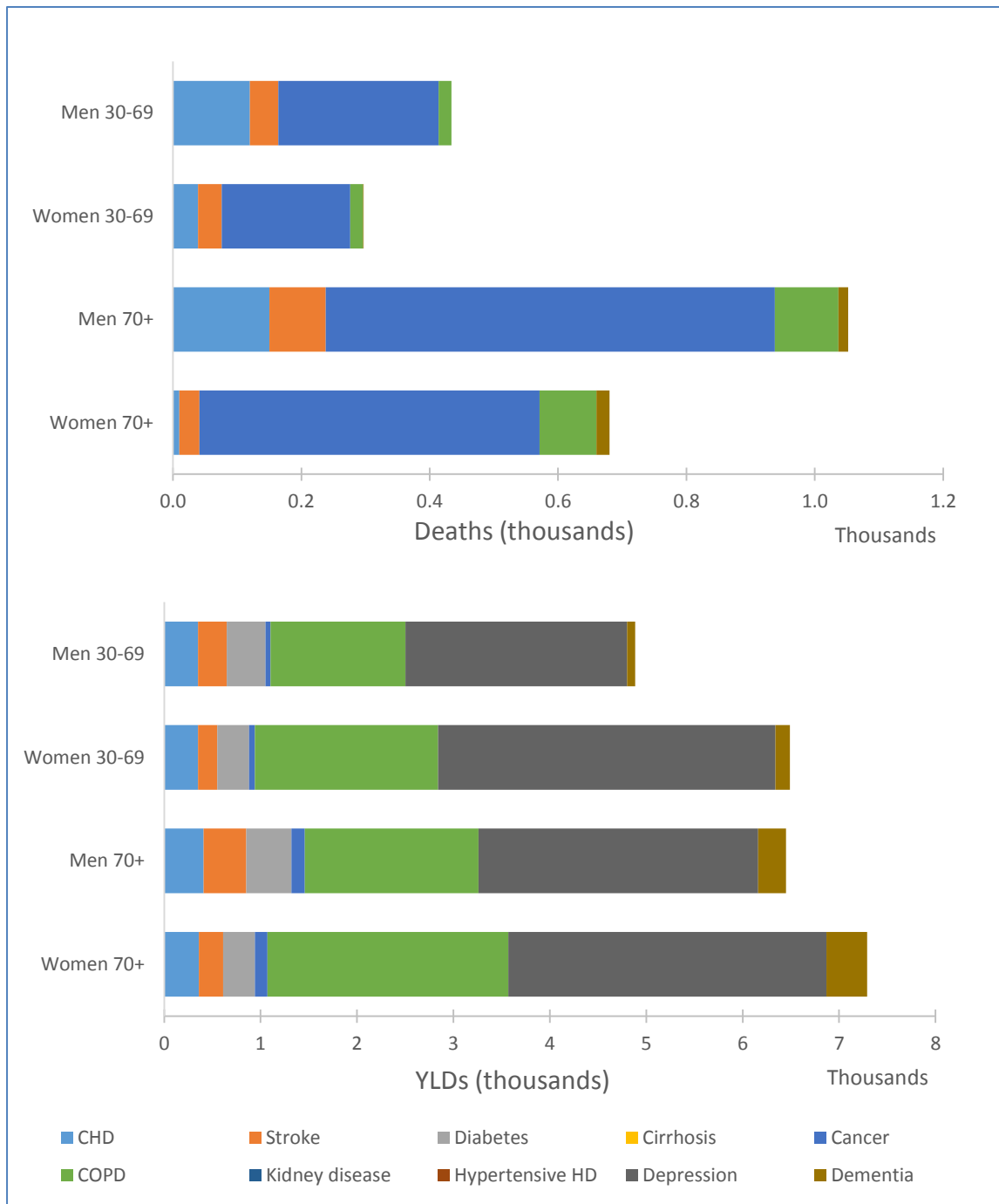
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<sup>58</sup> ASH. *Smoking Still Kills: Protecting children, reducing inequalities*. ASH: London, 2015.

<sup>59</sup> International Agency for Research on Cancer. *Effectiveness of Tax and Price Policies for Tobacco Control*. International Agency for Research on Cancer: Lyon, 2011.

<sup>60</sup> ASH. *ASH analysis of tobacco tax increases in the United Kingdom*. [http://www.ash.org.uk/files/documents/ASH\\_976.pdf](http://www.ash.org.uk/files/documents/ASH_976.pdf) (Accessed on 8 December 2015).

**Figure 6: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with an increase in tobacco tax.**



**Table 6: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with an increase in tobacco tax.**

	Deaths		YLDs	
	Men	Women	Men	Women
CHD	270 (250 to 290)	49 (-1.5 to 100)	760 (730 to 780)	700 (650 to 750)
Stroke	130 (120 to 140)	68 (7.0 to 130)	740 (730 to 750)	460 (390 to 520)
Diabetes	-10 (-25 to 4.5)	-18 (-37 to 0.5)	870 (860 to 890)	650 (630 to 670)
Cirrhosis	-	-	-	-
Mouth cancer	-	-	-	-
Oesophagus cancer	35 (32 to 39)	9.0 (5.5 to 13)	0 (-3.5 to 3.5)	0 (-3.5 to 3.5)
Colorectal cancer	-	-	-	-
Liver cancer	24 (10 to 38)	14 (4.5 to 24)	2.0 (-12 to 16)	0 (-10 to 10)
Pancreas cancer	45 (40 to 50)	38 (33 to 44)	0 (-5.0 to 5.0)	0 (-5.5 to 5.5)
Larynx cancer	6.0 (-5.5 to 18)	0 (0 to 0)	0 (-12 to 12)	0 (0 to 0)
Lung cancer	770 (520 to 1,000)	620 (400 to 850)	130 (-120 to 380)	160 (-67 to 380)
Breast cancer	-	-	-	-
Cervix cancer	-	18 (15 to 21)	-	18 (15 to 21)
Kidney cancer	10 (9.0 to 11)	0 (-3.0 to 3.0)	2.0 (1.0 to 3.0)	0 (-3.0 to 3.0)
Bladder cancer	42 (37 to 47)	16 (8.0 to 24)	50 (45 to 55)	18 (10 to 26)
Stomach cancer	20 (20 to 21)	6.0 (5.5 to 07)	0 (-0.5 to 0.5)	0 (-0.5 to 0.5)
COPD	120 (120 to 120)	110 (89 to 130)	3,200 (3,200 to 3,200)	4,400 (4,400 to 4,400)
Kidney disease	-	-	-	-
Hypertensive HD	-	-	-	-
Depression	-	-	5,200 (5,200 to 5,200)	6,800 (6,800 to 6,800)
Dementia	15 (-12 to 42)	21 (-23 to 65)	370 (340 to 400)	570 (530 to 610)

*NB. Values are mean and 95% uncertainty intervals, rounded to two significant figures.*

### Tackling illicit trade in cigarettes

Silvano et al (2014)<sup>61</sup> report on their study to estimate the size of the illicit trading of cigarettes in Europe. They found an overall proportion of illicit cigarettes of 6.5%, with wide variations across countries, with higher proportions particularly in countries geographically close to known major suppliers of illicit cigarettes. They suggest that defining a measure of illicit trade of cigarettes is complex, transparent public data are limited and conclude that, contrary to arguments made by the tobacco industry that tax/price increases fuel illicit trade practices, the supply of illicit tobacco is a key issue.

Joossens et al (2009)<sup>62</sup> report on the scale of global illicit tobacco trade and find that “Higher income countries, where cigarettes are more expensive, have lower levels of cigarette smuggling than lower income countries. Other factors, including the presence of informal distribution networks, organized crime, industry participation, and corruption, probably contribute more to cigarette smuggling than price levels.”

Joossens et al (2008)<sup>63</sup> report on how controlling the supply chain has been an effective mechanism to reduce illicit cigarette trade. They suggest that a combination of better detection, increased punishment, more enforcers and government scrutiny of tobacco companies contributed to a fall in smuggling activity in the UK.

ASH (2015)<sup>64</sup> suggests that although illicit trade in cigarettes has fallen in the UK over time, existing targets to tackle illicit trade are weak and need strengthening. The report recommends the following actions:

- Fully implement the WHO Illicit Trade Protocol including an international tracking and tracing regime for tobacco products.
- Strengthen and resource national, regional and local partnerships to enable co-ordinated action on illicit trade.
- Set new targets for the control of tobacco smuggling:
  - Reduce the illicit market share for cigarettes to no more than 5% by 2020
  - Reduce the illicit market share for hand-rolled tobacco to no more than 22% by 2020 and no more than 11% by 2025.

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<sup>61</sup> Silvano G, Lugo A, La Vecchia C, Boffetta P, Chaloupka F, Colombo P, et al. Pricing Policies And Control of Tobacco in Europe (PPACTE) project: cross-national comparison of smoking prevalence in 18 European countries. *Eur J Cancer Prev*, 2014;23(3):177-185.

<sup>62</sup> Joossens L, Merriman D, Ross H, Raw M. *How eliminating the global illicit cigarette trade would increase tax revenue and save lives*. International Union Against Tuberculosis and Lung Disease: Paris, 2009.

<sup>63</sup> Joossens L, Raw M. Progress in combating cigarette smuggling: controlling the supply chain *Tobacco Control*, 2008;17:399–404.

<sup>64</sup> ASH. *Smoking Still Kills: Protecting children, reducing inequalities*. ASH: London, 2015.



### Increased support for smoking cessation services, particularly in hard to reach groups

The Smoking Still Kills report<sup>65</sup> includes the following recommendation in relation to smoking cessation services:

- Ensure that good quality evidence-based Stop Smoking Services are accessible to all smokers, particularly those from lower socio-economic groups and disadvantaged populations.

NICE (2013)<sup>66</sup> issued public health guidance for smoking cessation services and recommend that action should be taken to ensure the local NHS Stop Smoking Service aims to treat minority ethnic and disadvantaged groups at least in proportion to their representation in the local population of tobacco users.

Bauld et al (2010)<sup>67</sup> report the findings of a systematic review which included 20 studies (sourced from 1990-2007) which explored the effectiveness of NHS smoking cessation services. They conclude that although NHS stop smoking services help smokers to quit, these services seem to have less impact on smoking rates in some groups of smokers, including younger people, women, pregnant women and more deprived smokers. Bauld et al highlight the lack of evidence available to enable appropriate sub-group analyses.

Twyman et al (2014)<sup>68</sup> carried out a systematic review into the barriers faced by smokers categorised as 'vulnerable'. The review examined 65 studies and concluded that "Barriers common to all vulnerable groups included: smoking for stress management, lack of support from health and other service providers, and the high prevalence and acceptability of smoking in vulnerable communities. Unique barriers were identified for people with a mental illness (e.g. maintenance of mental health), Indigenous groups (e.g. cultural and historical norms), prisoners (e.g. living conditions), people who are homeless (e.g. competing priorities) and at-risk youth (e.g. high accessibility of tobacco)."

Stanton and Grimshaw (2013)<sup>69</sup> report on an updated Cochrane review looking at tobacco cessation interventions for young people. They included 28 RCTs and concluded that although some interventions showed promise, there is a need for further research to be undertaken in order to understand how most effectively to help young smokers to quit.

Chamberlain et al (2013)<sup>70</sup> report on an update of a Cochrane review which looked at data of 86 trials of psycho-social interventions designed to help pregnant women to stop smoking. They found

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<sup>65</sup> *ibid*

<sup>66</sup> NICE. *School-based interventions to prevent the uptake of smoking among children and young people Evidence Update 2013*. NICE: London, 2013.

<sup>67</sup> Bauld L, Bell K, McCulloch L, Richardson L, Greaves L. The effectiveness of NHS smoking cessation services: a systematic review. *Journal of Public Health*, 2010;32(1):71-82.

<sup>68</sup> Twyman L, Bonevski B, Paul C, Bryant J. Perceived barriers to smoking cessation in selected vulnerable groups: a systematic review of the qualitative and quantitative literature. *BMJ Open*, 2014;4: e006414.

<sup>69</sup> Stanton A, Grimshaw G. Tobacco cessation interventions for young people. *Cochrane Database of Systematic Reviews*, 2013;8:CD003289.

<sup>70</sup> Chamberlain C, O'Mara-Eves A, Oliver S, Caird JR, Perlen SM, Eades SJ, et al. Psychosocial interventions for supporting women to stop smoking in pregnancy. *Cochrane Database of Systematic Reviews*, 2013;10:CD001055.

that these interventions were effective and suggest that providing incentives may be a helpful strategy.

Van der Meer et al (2013)<sup>71</sup> report the findings of a Cochrane review into smoking cessation interventions for smokers with current or a history of depression. They found that adding ‘mood management’ to standard smoking cessation increases long-term cessation rates in smokers with past or current depression. They also suggest that an anti-depressant medication (Bupropion) is helpful for smokers with a history of depression but not for those with current depression. The authors point to the lack of available evidence regarding the use of other types of anti-depression medication and, more generally, for smoking cessation services for people who have depression or have previously suffered from depression. NICE finds that there is insufficient available evidence to understand how to offer smoking cessation services to people in institutional settings with mental illnesses<sup>72</sup>.

NICE public health guidance 10 reports evidence that suggests that only a small number of prisoners access smoking cessation services despite a higher proportion wanting help to stop smoking, and that smoking cessation services can help prisoners to stop smoking, although differences in rates of success vary between institutions<sup>73</sup>.

## ALCOHOL CONSUMPTION

### Regulation to raise the price of high strength cheap alcohol

Martineau et al (2013)<sup>74</sup> report the findings of a review of systematic reviews of population-based interventions designed to reduce alcohol consumption and alcohol-related harm. This review of 52 reviews (sourced from 2002-2012) included 3 medium quality (author defined) reviews on taxation and concluded that there is consistent evidence that increasing alcohol price or taxation reduces overall consumption and related harm. The authors suggest that such policies present practical and political implementation difficulties.

In their systematic review of 112 studies looking at the relationship between alcohol tax or price levels and alcohol sales or self-reported drinking, Wagenaar et al (2009)<sup>75</sup> report a strong inverse relationship between price and consumption, that is, as alcohol prices increase alcohol consumption correspondingly falls. The authors report that “the meta-analyses reported here demonstrate the statistically overwhelming evidence of effects of alcohol prices on drinking. Price affects drinking of all types of beverages, and across the population of drinkers from light drinkers to heavy drinkers. We know of no other preventive intervention to reduce drinking that has the numbers of studies and consistency of effects seen in the literature on alcohol taxes and prices.”

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<sup>71</sup> Van der Meer RM, Willemsen MC, Smit F, Cuijpers P. Smoking cessation interventions for smokers with current or past depression. *Cochrane Database of Systematic Reviews*, 2013;8:CD006102.

<sup>72</sup> NICE. *School-based interventions to prevent the uptake of smoking among children and young people Evidence Update 2013*. NICE: London, 2013.

<sup>73</sup> NICE. *Stop smoking services. Public health guidance 10*. NICE: London, 2008.

<sup>74</sup> Martineau F, Tyner E, Lorenc T, Petticrew M, Lock K. Population-level interventions to reduce alcohol-related harm: an overview of systematic reviews. *Preventive Medicine*, 2013;57:278-296.

<sup>75</sup> Wagenaar A, Salois M, Komro K. Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction*, 2009;104:179–190.

Booth et al (2008)<sup>76</sup> conclude that there is consistent evidence to suggest an association between increases in taxation or pricing of alcohol and reductions in alcohol-related harm in their report for the Policy Research Programme of the Department of Health.

In 2010, the National Institute for Health and Care Excellence (NICE) produced public health guidance on alcohol which recommended policies which reduced the affordability of alcohol<sup>77</sup>. One mechanism to achieve this goal would be to introduce minimum unit pricing, where alcohol is priced according to its alcohol content, making products with high alcohol content more expensive. The NICE guidance included the following recommendations:

- Consider introducing a minimum price per unit. Set the level by taking into account the health and social costs of alcohol-related harm and its impact on alcohol consumption.
- Consider initiating a review of the excise duty regime with fellow EU member states. The aim would be to obtain a pan-EU agreement on harmonisation which links alcohol duty to the strength of each product. Regularly review the minimum price per unit to ensure alcohol does not become more affordable over time.
- Regularly review alcohol duties to make sure alcohol does not become more affordable over time

In 2013, the University of Stirling published a report by an independent group of experts calling for concerted action to reduce the harm caused by excessive alcohol consumption<sup>78</sup>. A key policy call in the report was to re-iterate the need to reduce the affordability of alcohol in order to reduce alcohol consumption and its associated harms.

Stockwell and Thomas (2013)<sup>79</sup> report findings from the Canadian experience of the introduction of minimum unit pricing. They support findings from previous research and conclude that significant health and social benefits would be gained from the introduction of minimum unit pricing in the UK. They also suggest that their results would have a differentially important impact on the heaviest drinkers compared with those with more moderate intakes of alcohol.

In 2012, the Scottish Parliament passed legislation to introduce a minimum retail price for alcohol to increase the price of cheap, strong alcohol to reduce alcohol-related harm. This law is still waiting enactment following opposition from the European Commission, suggesting that Martineau et al (2013)<sup>80</sup> were correct in their assertion about the complexities of implementation of policies influencing alcohol pricing.

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<sup>76</sup> Booth A, Meier P, Stockwell T, Sutton A, Wilkinson A, Wong R, et al. *Independent review of the effects of alcohol pricing and promotion*. SCHARR, University of Sheffield: Sheffield, 2008.

<sup>77</sup> NICE. *Alcohol-use disorders: Prevention (PH24)*. NICE: London, 2010.

<sup>78</sup> Anderson W (ed). *Health First: an evidence-based alcohol strategy for the UK*. University of Stirling: Stirling, 2013.

<sup>79</sup> Stockwell T, Thomas G. *Is alcohol too cheap in the UK? The case for setting a Minimum Unit Price for alcohol*. Institute of Alcohol Studies: London, 2013.

<sup>80</sup> Martineau F, Tyner E, Lorenc T, Petticrew M, Lock K. Population-level interventions to reduce alcohol-related harm: an overview of systematic reviews. *Preventive Medicine*, 2013;57:278-296.

### **Strengthen local authority control over licensing powers**

The University of Stirling (2013)<sup>81</sup> report sets out clear recommendations to assist with restricting the availability of alcohol to reduce alcohol-related harm and to tackle alcohol-related anti-social behaviour. The report recommends that:

- Public health should be a core objective and statutory obligation of licensing throughout the UK.
- Licensing legislation should be comprehensively reviewed. Licensing authorities must be empowered to tackle alcohol-related harm by controlling the total availability of alcohol in their jurisdiction.
- The sale of alcohol in shops should be restricted to specific times of the day and designated areas.
- The law prohibiting the sale of alcohol to people who are already drunk should be actively enforced.
- Local authorities should develop comprehensive alcohol strategies that prioritise public health and community safety.
- Measures to deal with the consequences of drunkenness must be complemented by measures to reduce the prevalence of drunkenness, including forward planning of the number, density and opening hours of all licensed premises.

Martineau et al (2013)<sup>82</sup> found 8 systematic reviews (assessed as mostly moderate quality) which addressed the issue of reducing alcohol availability. They present mixed results, with 2 reviews finding good evidence of effect for limiting hours of sale and 2 other reviews reporting conflicting results.

The NICE Local Government Briefing on alcohol (2012)<sup>83</sup> summarises the evidence-based recommendations made by NICE (NICE 2010 public health guidance) in relation to licensing and enforcement. These are:

- Using local health, crime and related trauma data, map the extent of alcohol-related problems locally before developing or reviewing a licensing policy. If an area has a lot of licensed premises, and the evidence suggests that additional premises may affect the licensing objectives, adopt a cumulative impact policy. This can be used to ensure an area offers a wide range of leisure and cultural-based activities, rather than just providing alcohol related entertainment.
- Ensure sufficient resources are available to prevent under-age sales (including proxy sales), sales to those who are intoxicated, non-compliance with any other alcohol licence condition, irresponsible drinks promotions and illegal imports of alcohol.
- Ensure sanctions are fully applied to businesses that break the law.

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<sup>81</sup> Anderson W (ed). *Health First: an evidence-based alcohol strategy for the UK*. University of Stirling: Stirling, 2013.

<sup>82</sup> Martineau F, Tyner E, Lorenc T, Petticrew M, Lock K. Population-level interventions to reduce alcohol-related harm: an overview of systematic reviews. *Preventive Medicine*, 2013;57:278-296.

<sup>83</sup> NICE. *Alcohol. Public health advice (LGB6)*. NICE: London, 2012.

We could find no review level evidence which evaluated the impact of implementing policies to strengthen local authority control over licencing powers, although research is underway to evaluate the use of cumulative impact policies on alcohol-related harm in a London Borough.

### **Further restriction of alcohol marketing**

The NICE (2010)<sup>84</sup> public health guidance on alcohol also includes recommendations to strengthen current regulations on alcohol marketing, particularly in relation to children and young people. NICE reports strong Cochrane review based evidence that alcohol advertising affects children and young people, is associated with the onset of drinking in young people and increases consumption in those who already drink alcohol. Recommendations include:

- Ensure children and young people's exposure to alcohol advertising is as low as possible by considering a review of the current advertising codes. This review would ensure:
  - the limits set by the Advertising Standards Authority (ASA) for the proportion of the audience under age 18 are appropriate where alcohol advertising is permitted.
  - there is adequate protection for children and young people.
  - all alcohol marketing, particularly when it involves new media (for example, web based channels and mobile phones) and product placement, is covered by a stringent regulatory system which includes ongoing monitoring of practice.
- Ofcom, the ASA and the government should keep the current regulatory structure under review.
- Assess the potential costs and benefits of a complete alcohol advertising ban to protect children and young people from exposure to alcohol marketing.

The NICE guidance<sup>85</sup> also states that there is a small but clear and consistent link between advertising expenditure and alcohol consumption but limited evidence examining a complete ban on advertising. The Programme Development Group (PDG) concluded that there should be a cost-benefit assessment of the impact of an advertising ban and suggested that alcohol-related product placement should not be encouraged.

Siegfried et al (2014)<sup>86</sup> published a Cochrane review which systematically examined the impact of the restriction or banning of alcohol advertising (via any format) to reduce alcohol consumption in adults and adolescents. This review included only 4 studies and rated their quality as low in all cases; the interventions either varied exposure to alcohol (in 1 case), explored the introduction of partial/total bans on advertising of alcohol in an area (2 studies) or the impact of the removal of an

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<sup>84</sup> NICE. *Alcohol-use disorders: Prevention (PH24)*. NICE: London, 2010.

<sup>85</sup> *ibid*

<sup>86</sup> Siegfried N, Pienaar DC, Ataguba JE, Volmink J, Kredo T, Jere M, et al. Restricting or banning alcohol advertising to reduce alcohol consumption in adults and adolescents. *Cochrane Database of Systematic Reviews*, 2014;11:CD010704.

advertising ban. The authors conclude that the existing evidence base does not show a clear effect either for or against alcohol advertising restrictions or bans. Siegfried et al (2014) call for further research to be undertaken to strengthen the evidence base in this area.

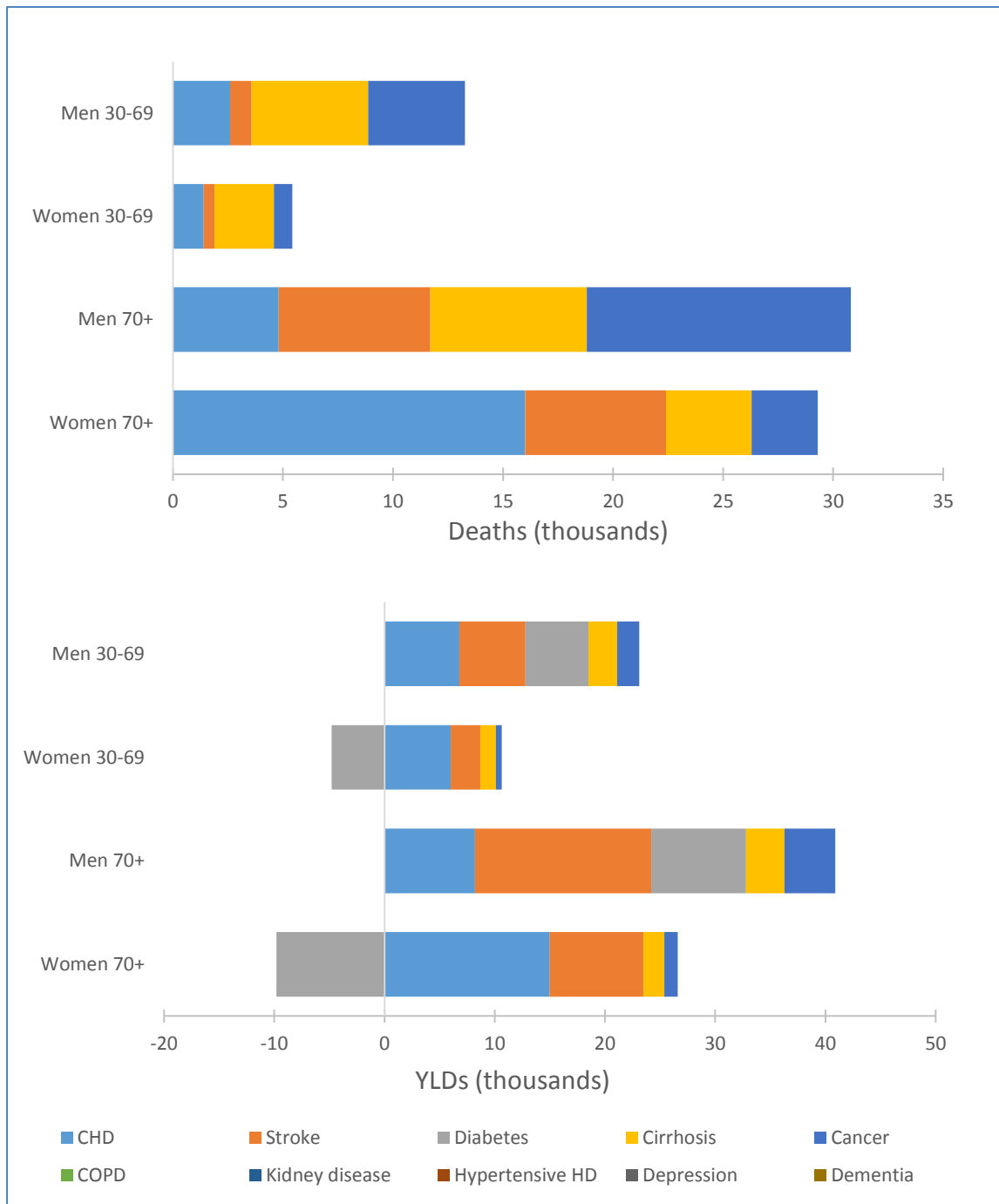
We modelled the impact of a total ban of advertising of alcohol products in England, using evidence on effectiveness from an econometric study by Saffer and Dave<sup>87</sup>. As the quality of evidence is low in this area, the results are accompanied with a large degree of uncertainty. Also, the intervention being modelled represents a large departure from the current situation, so the impact of such an intervention is likely to be large.

We estimated that implementing a ban on alcohol marketing in England would result in 44,000 (2,900 to 85,000) deaths averted or delayed in men, and 34,000 (-43,000 to 110,000) deaths averted and delayed in women up to 2025 (Figure 7 and Table 7). These delayed or averted deaths would mostly be from liver cirrhosis, oesophagus cancer, and cardiovascular diseases (although the results around cardiovascular disease are extremely uncertain). The intervention would also have a substantial impact on disability from NCDs, with potentially large reductions in disability from CHD and stroke in both men and women (albeit with large uncertainty).

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<sup>87</sup> Saffer H, Dave D. Alcohol consumption and alcohol advertising bans. *Applied Economics*, 2002;34:1325-1334.

**Figure 7: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with alcohol marketing restrictions.**



**NB. The increase in diabetes YLDs in women is due to a small increased risk of diabetes with falls in alcohol consumption<sup>88</sup>.**

<sup>88</sup> Shield K, Parry C, Rehm J. Chronic diseases and conditions related to alcohol use. *Alcohol Research: Current Reviews*, 2013;35(2):155-173.

**Table 7: NCD deaths and YLDs that are averted or delayed between 2015 and 2025 with alcohol marketing restrictions.**

	Deaths		YLDs	
	Men	Women	Men	Women
CHD	7,500 (-5,100 to 20,000)	17,000 (-42,000 to 76,000)	15,000 (2,400 to 28,000)	21,000 (-38,000 to 79,000)
Stroke	7,900 (1,700 to 14,000)	6,900 (-2,400 to 16,000)	22,000 (16,000 to 28,000)	11,000 (1,800 to 20,000)
Diabetes	-3.0 (-17 to 11)	-23 (-31 to -16)	14,000 (14,000 to 14,000)	-15,000 (-15,000 to -15,000)
Cirrhosis	12,000 (3,000 to 22,000)	6,500 (940 to 12,000)	6,100 (-3,300 to 16,000)	3,200 (-2,400 to 8,800)
Mouth cancer	4,300 (910 to 7,700)	1,000 (200 to 1,800)	2,700 (-670 to 6,100)	720 (-100 to 1,500)
Oesophagus cancer	8,000 (2,000 to 14,000)	1,500 (320 to 2,700)	1,500 (-4,600 to 7,500)	310 (-900 to 1,500)
Colorectal cancer	2,100 (260 to 4,000)	720 (50 to 1,400)	1,900 (22 to 3,700)	620 (-50 to 1,300)
Liver cancer	1,800 (97 to 3,500)	560 (23.0 to 1,100)	530 (-1,200 to 2,200)	140 (-400 to 670)
Pancreas cancer	-	-	-	-
Larynx cancer	-	-	-	-
Lung cancer	-	-	-	-
Breast cancer	-	-14 (-25 to -3.5)	-	-11 (-22 to -0.5)
Cervix cancer	-	-	-	-
Kidney cancer	-	-	-	-
Bladder cancer	-	-	-	-
Stomach cancer	-	-	-	-
COPD	-	-	-	-
Kidney disease	-	-	-	-
Hypertensive HD	-	-	-	-
Depression	-	-	-	-
Dementia	-	-	-	-

*NB. Values are mean and 95% uncertainty intervals, rounded to two significant figures.*



## CONCLUSIONS

The UK has made huge strides at reducing the burden of NCDs, with particularly large reductions in the burden of cardiovascular disease<sup>89</sup>. If we continue on this path then we will go a long way to achieving the WHO target of reducing premature mortality from NCDs by 25% by 2025 and this will involve maintaining current public health effort. However, the modelling conducted for this report shows that we will not achieve this goal without increasing current public health effort by tackling the prevalence of risk factors for NCD including poor diet, physical inactivity, smoking and alcohol consumption. Our results suggest that achieving the 25 by 25 targets for obesity and diabetes will have a much bigger impact on NCD outcomes than targets for salt consumption, blood pressure, smoking, alcohol consumption and physical activity, but this is primarily due to the ambitious nature of these targets which will require us to halt increases in the prevalence of both obesity and diabetes. In comparison, the other risk factor targets are much less ambitious, requiring a proportional reduction in risk factor prevalence rates that are already falling. Our results demonstrate that reducing all risk factors can contribute to reducing disease burden – not just from deaths, but increasingly from disability from chronic conditions, including depression and dementia.

The policy review demonstrates the range of potential policy options available to policy makers and stakeholders to address NCD risk factors. But it also shows the relative paucity of evidence for prevention-based interventions (particularly those interventions aimed at populations rather than individuals). Our review of policy options, across the four risk factors, uncovers three key challenges threatening further progress, which operate independently at present:

- (i) Developing and maintaining evidence and advocacy for reductions in the four risk factors.
- (ii) Identifying workable solutions.
- (iii) Encouraging policy makers to support and implement solutions.

There is need for smarter research not only to generate and develop the evidence base for each risk factor and evaluate policy interventions, but also to build a new evidence base around implementation. We found inverse relationships between the strength of evidence and population reach across all the risk factors. The prevention evidence base is still mostly defined with individualised rather than population-based interventions: this starts with the difficulty of defining population-based health interventions and is reflected in the 12 interventions included in the PROMISE study shortlist. We also highlight the almost complete dearth of evidence on how to implement workable solutions in everyday policy and practice.

Our modelling results for potential interventions across the four risk factor domains show how even relatively modest population-level interventions (e.g. small increases in tobacco taxation) can result in large health impacts if they can be effectively implemented across the whole population. Such modelling results are useful but they only consider one side of the cost-effectiveness equation: namely, ‘how much impact will this intervention have?’, but not ‘how much will this intervention cost?’. Hence they cannot address whether the interventions would be good value for money. The public health guidance produced by NICE often (but not always) includes estimates of cost-effectiveness of interventions, but results are not directly comparable across risk factor domains.

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<sup>89</sup> Townsend N, Bhatnagar P, Wilkins E, Wickramasinghe K, Rayner M. Cardiovascular disease statistics 2015. British Heart Foundation: London, 2015. <https://www.bhf.org.uk/publications/statistics/cvd-stats-2015>

Previous studies have considered the cost-effectiveness of public health interventions using comparable methods across risk factors in Australia<sup>90</sup> and the US<sup>91</sup>, and these studies show that many population-level interventions to address risk factors are cost-saving due to the reduced burden on health sector costs associated with lower disease incidence. Such comparable results are needed in the UK, alongside well-conducted evaluations of prevention-based policy interventions, to push the debate about disease prevention forward. Ideally, such economic analyses and evaluations would be conducted at the local authority level where much of the responsibility for addressing public health now lies. Even when public health measures are delivered at a national level, local level results are needed to assess impact on inequalities and provide information about the impact on budgets controlled at a local level.

Whilst better conducted research can improve the evidence base and refine prioritisation of public health interventions, we cannot allow a call for further research to halt action which is needed now. This report has demonstrated the potential impact that focussed prevention-based population-level interventions can have in the UK. It has reviewed the available evidence about implementation of 12 such interventions across multiple risk factor domains. It now lies with policy makers to implement (and evaluate) interventions to reduce the vast disease burden associated with poor diet, physical inactivity, smoking and alcohol consumption.

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<sup>90</sup> Carter R, Moodie M, Markwick A, Magnus A, Vos T, Swinburn B, et al. Assessing cost-effectiveness in obesity (ACE-Obesity): an overview of the ACE approach, economic methods and cost results. *BMC Public Health*, 2009;9:419.

<sup>91</sup> Gortmaker S, Long M, Resch S, Ward Z, Cradock A, Barrett J, et al. Cost-effectiveness of Childhood Obesity Interventions: Evidence and Methods for CHOICES. *American Journal of Preventive Medicine*, 2015;49(1):102–111.

## ABBREVIATIONS

ASH	<i>Action on Smoking and Health</i>
BAU	<i>Business As Usual</i>
BHF	<i>British Heart Foundation</i>
COPD	<i>Chronic Obstructive Pulmonary Disease</i>
CHD	<i>Coronary Heart Disease</i>
CVD	<i>Cardiovascular Disease</i>
DALY	<i>Disability Adjusted Life Year</i>
IPTFA	<i>Industrially Produced Trans Fatty Acids</i>
NCD	<i>Non-Communicable Disease</i>
PIF	<i>Population Impact Fraction</i>
RCT	<i>Randomised Controlled Trial</i>
WHO	<i>World Health Organization</i>
YLD	<i>Years of Life lived with Disability</i>

## DEFINITIONS

25 by 25 targets	<i>A set of targets set by the WHO for improvements in obesity, diabetes, raised blood pressure, tobacco use, salt intake, physical inactivity and harmful use of alcohol, with the aim of achieving a 25% reduction in premature mortality by the year 2025.</i>
Business as usual	<i>The baseline projections for the modelling study, where it is assumed that current trends in risk factors, NCD incidence and NCD mortality will continue up to 2025 under the assumption that current efforts to prevent and treat NCDs will continue as usual.</i>
Disability Adjusted Life Year	<i>In this project, DALYs are a summary measure of the years of life lived by a population, adjusted for time spent with disability. The loss of health is estimated using YLD estimates from the Global Burden of Disease project.</i>
Intervention	<i>A policy initiative or public health project designed to reduce poor diet, physical inactivity, smoking or alcohol consumption.</i>
Population impact fraction	<i>A measure of the proportion of a disease that would be reduced or increased in a given risk factor scenario.</i>
Premature mortality	<i>Death from any condition before the age of 70.</i>