Modelling the impact of Minimum Unit Price and Identification and Brief Advice policies using the Sheffield Alcohol Policy Model Version 3

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Erratum

This report has been amended to correct a reporting error in Table 4.8 which understated the estimated full effect impact of Minimum Unit Pricing policies on increasing and high risk drinkers using the broad measure. All other figures in the report are unaffected.

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1 EXECUTIVE SUMMARY

1.1 Main conclusions

Modelling results from SAPM3 suggest that for England:

1) Minimum Unit Pricing (MUP) policies are an effective and well-targeted measure for reducing alcohol-related harm
2) Higher MUP thresholds lead to greater reductions in harm, however they increase the impact on moderate drinkers
3) National-level Identification and Brief Advice (IBA) policies are highly likely to be health-improving and cost-saving
4) The inclusion of IBAs as an ongoing part of the NHS Health Checks is highly likely to be health-improving and cost-saving
5) Increasing uptake rates, both amongst General Practitioners (GPs) delivering IBAs in general practice and patients receiving Health Check invitations, is likely to be cost-effective even if this involves significant investment
6) MUP policies are likely to have a substantially greater impact in terms of reducing absolute socioeconomic inequalities in health than IBA policies, unless these are targeted at lower socioeconomic groups.

1.2 Research questions

- What is the estimated impact of MUP policies ranging from 45-60p per unit?
- What is the estimated impact of national level IBA policies at next GP registration or next GP consultation?
- What is the estimated impact of including IBAs as part of the NHS Health Checks?
- How do these impacts vary by drinking level and socioeconomic status?

1.3 Summary of model findings

1.3.1 Baseline alcohol consumption, spending and harm

F1. Based on data from 2012 for the English population, the proportion of abstainers from drinking, drinkers at moderate (less than 21 units per week for men and 14 for women), increasing risk (21-50 units per week for men and 14-35 for women) and high risk (more than 50 units per week for men and 35 for women) levels are 15.0%, 63.8%, 16.5% and 4.7% respectively.

F2. Moderate drinkers consume on average 5.5 units per week, spending £364 per annum on alcohol. Increasing risk drinkers consume 26.8 units per week, spending £1,257 per annum, and high risk drinkers consume on average 76.7 units per week, spending on average £2,883 per annum. Increasing and high risk drinkers combined (21% of the population) account for 70% of all alcohol consumption and 62% of all spending on alcohol. High risk drinkers alone (4.7% of the population) are responsible for 31% of consumption and 25% of all spending.

F3. 8.3% of people aged 16+ in the highest modelled socioeconomic group are abstainers, compared to 20.9% of people in the lowest group. In the highest group 68% of people drink at moderate levels (consuming an average of 6.3 units per week and spending £374 per annum on alcohol), 19.6% of people are increasing risk drinkers and 4.6% of people are high risk drinkers, with the latter group consuming an average of 72 units per week and spending £2,838 per annum on alcohol. In contrast, of those in the lowest socioeconomic group, 61.6% drink at moderate levels (consuming an average of 4.8 units per week and spending £280 per annum on alcohol), 12.9% of people are increasing risk drinkers and 4.6% of people are high risk drinkers, with the latter group consuming an average of 79.3 units per week and spending £2,970 per annum on alcohol.

F4. Moderate, increasing risk and high risk drinkers in lower income groups purchase more of their alcohol, both relatively and absolutely, for less than 50p per unit than those in higher income groups. High risk drinkers purchase significantly more of their alcohol below this threshold than moderate drinkers (55% vs. 28% for those in the lowest income quintile and 31% vs. 11% for those in the highest).

F5. Overall we estimate 12,190 deaths and 840,037 hospital admissions (using the broad measure, the equivalent figure for the narrow measure is 262,166) per year are attributable to alcohol. These harms are concentrated primarily amongst high risk drinkers, amongst whom 83% of all alcohol-attributable deaths and 51% of alcohol-attributable hospital admissions occur. Similarly, harms are concentrated amongst those in lower socioeconomic groups, with 51% of all alcohol-attributable deaths and 50% of hospital admissions occurring in the lowest group.

F6. Overall we estimate a total of 1.4m alcohol-attributable crimes are committed per year in the population.

F7. Each year we estimate a total of 7.7m days work are lost due to alcohol-attributable absence.

1.3.2 Impact of MUP policies

F8. For a 50p MUP, the estimated per person reduction in alcohol consumption is 1.8%. In absolute terms this equates to an annual average reduction of 12.6 units per drinker per year. Increasing MUP thresholds lead to correspondingly larger reductions in consumption (45p=1.1%, 55p=2.7%, 60p=3.9%)

F9. MUP policies are estimated to lead to significantly larger reductions in consumption for high risk drinkers than for moderate or increasing risk drinkers. For a 50p MUP the estimated reductions are 3.3% for high risk drinkers (equating to fewer 134 units per year), 1.2% for increasing risk drinkers and 0.9% for moderate drinkers (equating to 2.6 units per year). Reductions are substantially greater for those in lower socioeconomic groups, for example those in the lowest group are estimated to reduce their drinking by 3.8% under a 50p MUP (equivalent to 25.7 units per year) whilst those in the highest group are unaffected (0.0% change).

F10. Under MUP policies, drinkers are estimated to pay slightly more on average per unit consumed. For all modelled policies, spending across the whole population is estimated to increase, for example by £10.80 (+1.7%) per drinker per year for a 50p MUP alongside a consumption change of -1.8%. Spending changes differ across the population, with high risk drinkers estimated to spend an extra £81.30 (+2.8%) per year whilst moderate drinkers' spend an extra £2.40 (under 5p more per week on average, +0.7%) under a 50p MUP.

F11. Unlike differences in alcohol consumption, those in lower socioeconomic groups are estimated to experience smaller overall changes in spending under MUP policies than those in higher groups.

For example, under a 50p MUP those in the highest socioeconomic group are estimated to increase their spending by £15.80 (+2.3%) while those in the lowest group increase their spending by £3.90 per year (+0.6%).

F12. There are considerable estimated reductions in alcohol-related health harms from all modelled policies, with an estimated 530 fewer deaths (-4.3%) and 22,797 fewer hospital admissions (-2.7%) per year (using the broad measure, the equivalent figures for the narrow measure are 8,153 and -3.1%) under a 50p MUP.

F13. After accounting for differences in population size, heavier drinkers, and those in lower socioeconomic groups, accrue proportionately more of the gains in health. In particular, high risk drinkers in the lowest socioeconomic group experience almost double the gains in terms of reduced mortality and hospital admissions, of any other population subgroup (e.g. 27,436 fewer hospital admissions per year per 100,000 population compared to 18,940 for increasing risk drinkers in the lowest socioeconomic group, or 7,181 for high risk drinkers in the next lowest socioeconomic group under a 50p MUP).

F14. Crime is expected to fall, with an estimated 34,951 fewer offences per year under a 50p MUP. High risk drinkers, who comprise 4.7% of the population account for 11% of this reduction.

F15. Workplace absence is estimated to fall under all modelled policies, with a reduction of 156,000 days absent per year for a 50p MUP.

F16. Over 20 years the cumulative net benefit (after discounting) of a 50p MUP policy is estimated to be £8.4bn. This figure includes direct healthcare savings (£1.4bn), savings from reduced crime and policing (£2.2bn), savings from reduced workplace absence (£0.2bn) and a financial valuation of the health benefits measured in terms of Quality-Adjusted Life Years (QALYs – valued at £60,000 in line with Department of Health guidelines (1)) (£4.7bn). Using the ‘narrow’ rather than the ‘broad’ definition of hospital admissions reduces the total estimated saving to £5.9bn.

1.3.3 Impact of national IBA policies in primary care

F17. A policy of delivering IBAs to every patient at their next registration with a new GP (in line with current NICE guidance (2)) is estimated to lead to 19.7% of the population receiving an AUDIT questionnaire and 6.6% receiving a session of Brief Advice. Equivalent figures for a policy of delivering IBAs to every patient at their next GP consultation are 84.3% and 25.1% respectively.

F18. Over 20 years a policy of IBA at next registration is estimated to lead to 2,430 fewer alcohol-attributable deaths (-1.9%) and 124,954 fewer hospital admissions (-0.9%). Equivalent reductions for IBA at next consultation are 8,835 (-6.8%) and 396,623 (-2.7%) respectively.

F19. For all modelled policies, those in the lowest socioeconomic groups are estimated to experience the greatest absolute reduction in harms (1,073 fewer deaths vs. 781 in the highest socioeconomic group for IBAs at next registration) but the lowest relative reduction (-1.6% vs. 2.3%) as they have a higher baseline level of alcohol-attributable harm.

F20. All modelled policies are estimated to lead to healthcare savings to the NHS which far exceed the cost of delivering the IBAs. The net saving for a programme of IBAs at next registration is £282m over 20 years, or £1.1bn for IBAs at next consultation. As all programmes are also health-improving (e.g. a gain of 27,000 QALYs over 20 years for IBAs at next registration), this means all policies are health-improving and cost-saving compared to a scenario in which no IBAs are delivered in primary care.

1.3.4 Impact of IBAs within NHS Health Checks

F21. Over a single 5-year Health Checks cycle we estimate 6.16m Health Checks will be delivered, leading to 1.76m patients receiving Brief Advice sessions. Delivery of Brief Advice sessions is highest in higher socioeconomic groups, with 13.8% of 40-74 year olds in the highest group receiving a BA compared to 9.1% of those in the lowest group.

F22. Total health gains are estimated to be substantial, with 1,855 fewer alcohol-attributable deaths and 85,740 fewer hospital admissions over 20 years. Whilst the absolute gains are greater in the highest socioeconomic group (747 fewer deaths vs. 629 in the lowest group), after adjusting for population sizes, the greatest relative gains are in the lowest socioeconomic group (e.g. 139.5 QALYs gained per 100,000 population compared to 109.6 in the highest socioeconomic group).

F23. Over 5 years the estimated cost of delivering IBAs within the Health Checks is £35m, which is offset by reduced healthcare costs of £298m over 20 years, giving a net saving of £262m to the NHS. The programme is therefore estimated to be both cost-saving and health-improving compared to having no IBAs within the Health Checks.

F24. Increasing the uptake rate of patients invited for a Health Check would lead to both greater net savings and greater health gains. For example, an increase to 66% uptake (from the current rate of 48%) would save an additional £96.8m over 20 years and generate 6,550 additional QALYs. This increase would therefore be considered cost-effective under current NICE decision rules (3) assuming the increase in uptake had cost no more than £228m.

2 INTRODUCTION

2.1 Background

In 2009 the Sheffield Alcohol Research Group (SARG) at the University of Sheffield developed the Sheffield Alcohol Policy Model 2.0 (SAPM) to appraise the potential impact of alcohol policies, including different levels of Minimum Unit Pricing (MUP) and a range of Identification and Brief Advice (IBA, previously referred to as Screening and Brief Interventions, or SBI) policies on the English population (4). This model has subsequently been adapted to a range of other settings, both within the UK and internationally (5–7).

Since 2009 the methodology which underpins SAPM has been further developed and advanced. Some of these methodological developments have previously been described elsewhere (8,9); however the results presented in this report incorporate a number of additional improvements which have not previously been reported for England. In order to avoid confusion with previous versions of the model, the current version is referred to as SAPM3 throughout the current report.

2.2 Research questions addressed

In August 2014 SARG were commissioned by Public Health England (PHE) to produce new modelling using SAPM3 work to examine 3 issues:

1. Estimate the impact of MUP policies and quantify the impact on these estimates of using the new ‘narrow’ measure of hospital admissions
2. Estimate the impact and cost-effectiveness of national IBA policies in primary care
3. Estimate the impact and cost-effectiveness of the inclusion of IBA as part of the NHS Health Checks programme for those aged 40-74.

3 METHODS

3.1 Overview of SAPM3

The aim of SAPM3 is to appraise alcohol policy options via cost-effectiveness and cost-benefit analyses. This is achieved by breaking the policy impact into a series of linked effects to be modelled:

- For pricing policies:
    - The effect of the policy on the distribution of prices for different types of alcohol
    - The effect of changes in price distributions on patterns of both on-trade and off-trade alcohol consumption
    - The effect of changes in alcohol consumption patterns on consumer spending on alcohol
    - The effect of changes in alcohol consumption patterns on levels of alcohol-related health harms
    - The effect of changes in alcohol consumption patterns on levels of alcohol-related crime
    - The effect of changes in alcohol consumption patterns on levels of workplace absenteeism
- For IBA policies:
    - The effect of the policy on IBA delivery rates in the population of interest
    - The effect of changes in IBA delivery rates on patterns of overall alcohol consumption
    - The effect of changes in alcohol consumption patterns on levels of alcohol-related health harms

In order to estimate the range of these effects, SAPM3 consists of two connected models:

1. A model of the relationship between alcohol policies and alcohol consumption which accounts for the relationship between: average weekly alcohol consumption, the patterns in which that alcohol is drunk and how these are distributed within the population considering gender, age, income/socioeconomic status and consumption level
2. A model of the relationship between: (1) both average level and patterns of alcohol consumption and (2) harms related to health and workplace absenteeism and the costs associated with these harms.

As the methods used in the first of these models differs substantially when the model is used to appraise pricing or IBA policies, we will describe each of these approaches and the relevant data used in turn, before describing the methodology and data which underpins the second model, which is common to both policy types.

3.2 Modelling the relationship between MUP policies and consumption

3.2.1 Overview

The pricing model uses a simulation framework based on classical econometrics. The fundamental concept is that: (i) a current consumption dataset is held for the population, (ii) a policy gives rise to a change in price, (iii) a change in consumption is estimated from the price change using the price elasticity of demand, and (iv) the consumption change is used to update the current consumption dataset. Full details of the pricing model have been published elsewhere (8) and the present report therefore focuses on the developments and new data sources implemented in SAPM3.

3.2.2 Consumption data

Estimates of alcohol consumption for people in England aged 16 and over are taken from the Health Survey for England (HSE) 2012. This survey records a range of demographic data on respondents, including: age, sex, income, socioeconomic status measured using the NS-SEC classification, mean weekly alcohol consumption and alcohol consumption on the day in the previous week in which the respondent drank the most (henceforth referred to as peak day max). Figure 2.1 and 2.2 present the distribution of mean and weekly consumption by age and sex. HSE2012 respondents are used as the baseline population of the model (N=6,394).

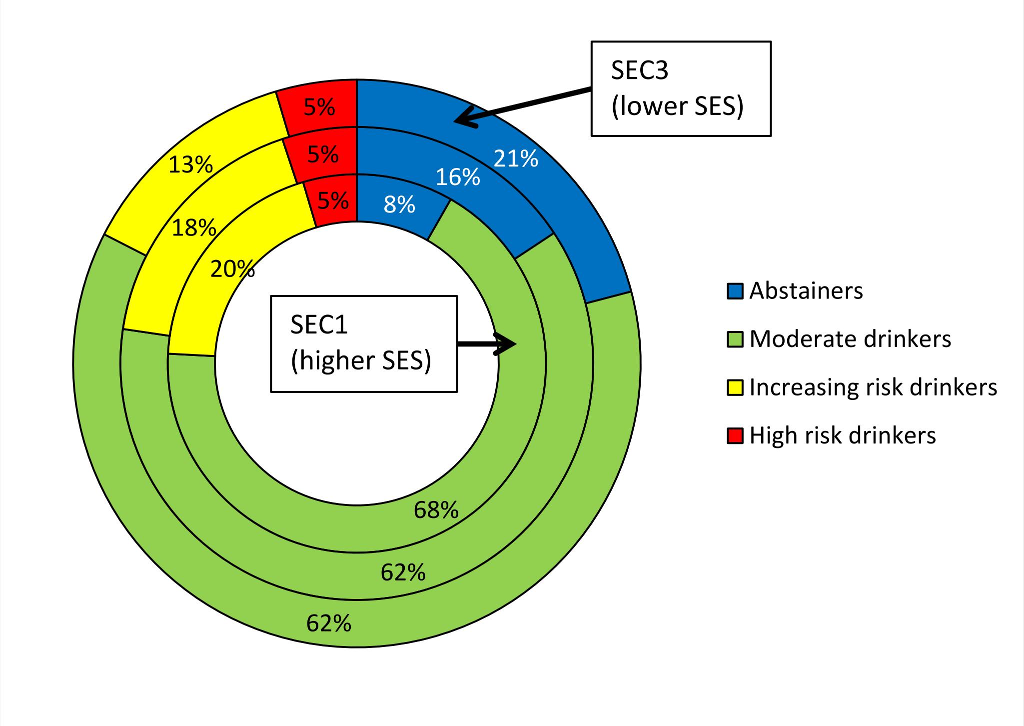
This population is divided into three drinker groups:

- Moderate drinkers – those whose usual alcohol intake is no more than 21/14 units per week for men/women (1 unit = 8g of ethanol)
- Increasing risk drinkers – those drinkers consuming 21-50 units per week for men or 14-35 units per week for women
- High risk drinkers – drinkers whose usual alcohol intake exceeds 50/35 units per week for men/women.

Overall, from the HSE data, 15.0% of the adult population (16+) are abstainers, 63.8% are moderate drinkers, 16.5% are increasing risk drinkers and 4.7% are high risk drinkers. On average moderate drinkers consume 4.8 units per week, increasing risk drinkers consume 27.8 units and high risk drinkers consume 79.3 units. Figure 3.1 illustrates how consumption patterns differ by socioeconomic status (SES)[1]. Individuals in the lowest SES group are more likely to be abstainers than those in the highest group (20.9% vs. 8.3%), while at the upper end of the spectrum they are equally likely to drink at high risk levels (4.6%). Within the moderate drinker groups, those in the lowest SES group drink less on average (4.8 units per week vs. 5.5 units for the highest SES group), whereas increasing and high risk drinkers in the lowest SES group drink more (27.8 and 79.3 units per week on average respectively vs. 26.8 and 72.0 units for the highest SES group).

[1] Socioeconomic status is defined here using the National Statistics Socioeconomic Classification (NS-SEC). Individual respondents to the HSE are grouped into those with managerial or professional (SEC1), intermediate (SEC2) and routine, manual occupations and the unemployed (SEC3). For further details please see (9).

Figure 3.1 - Population distribution by drinker and socioeconomic group (HSE 2012)

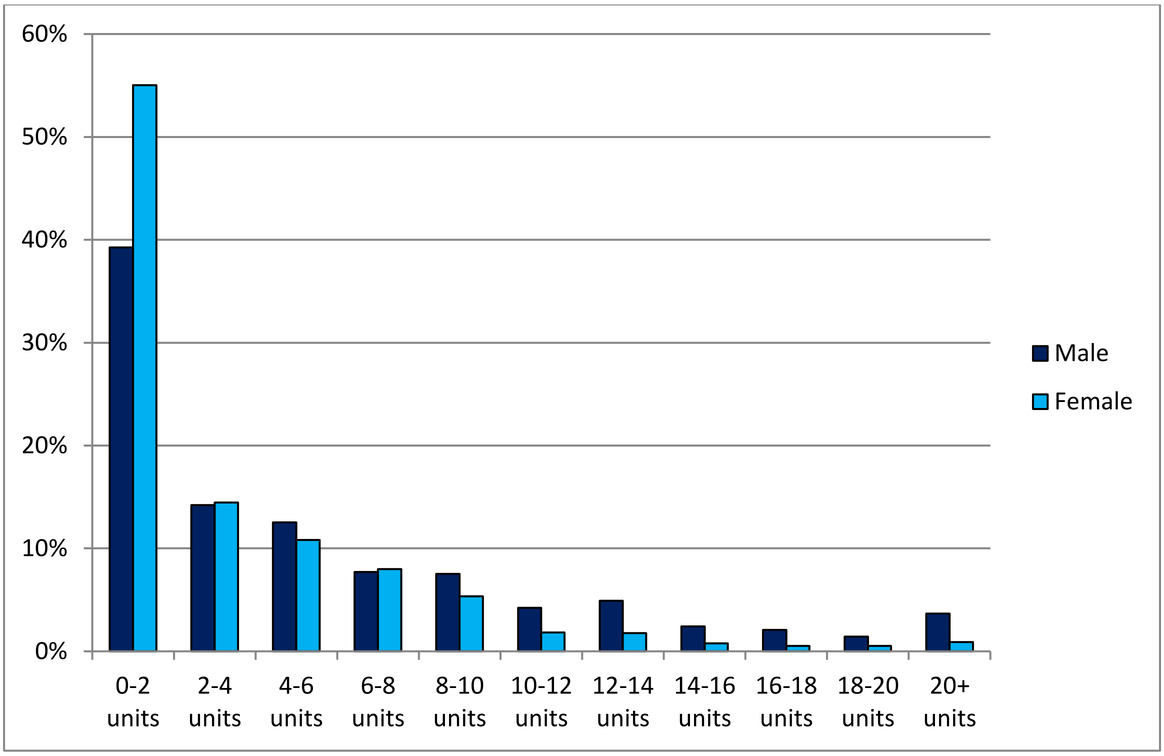


3.2.3 Patterns of consumption

In addition to mean weekly consumption of alcohol, a significant number of the harms modelled in SAPM3 are a function of intoxication; that is to say that they are related to the patterns in which alcohol is drunk, not just the overall volume consumed. This is accounted for in the model in two ways:

- For acute health conditions (i.e. those related to intoxication) which are wholly attributable to alcohol (e.g. ethanol poisoning) we use peak day max as a proxy measure for consumption patterns and relate this measure to wholly-attributable acute health conditions and crime harms.
- Figure 3.2 shows how the distribution of this varies by gender.
- For acute health conditions which are partially attributable to alcohol (e.g. transport injuries) a new method has been applied which accounts for the heterogeneity of an individual's drinking patterns across the whole year and the impact this has on their risk of suffering intoxication-related harm (see Section 3.5.4.3 for details).

Figure 3.2 - Distribution of peak day maximum consumption by gender (HSE2012)



3.2.4 Prices

Data on the prices paid for alcoholic beverages are taken from the Living Costs and Food Survey, using pooled data from 2001/2-2009 (N=227,933 transactions) inflated to 2014 prices using alcohol-specific inflation indices. Prices for alcohol purchased in the off-trade are further adjusted to aggregate-level sales data for 2012 for England and Wales published by NHS Health Scotland (10) using previously-described methods (4). A further adjustment is made in order to account for the impact of the ban on below-cost selling introduced by the government in May 2014, with the small proportion of transactions which involve alcohol being sold for less than the cost of the duty and VAT payable on that beverage having their prices increased to this threshold. Figure 3.3 shows the final overall price distribution used in the model, stratified by drinker group. It should be noted that separate price distributions are derived and applied within the model for each age group, gender, income group[2] and beverage type (on- and off-trade beer, cider, wine, spirits and RTDs).

[2] Price distributions are constructed and applied based on the HSE respondent's income quintile. Note that the HSE includes both a respondent's equivalised household income and NS-SEC and there is therefore no mapping or assumed equivalence between these different measures.

Figure 3.3 - Overall distribution of prices paid by drinker group (LCFS 2001-2009 & Nielsen 2012)

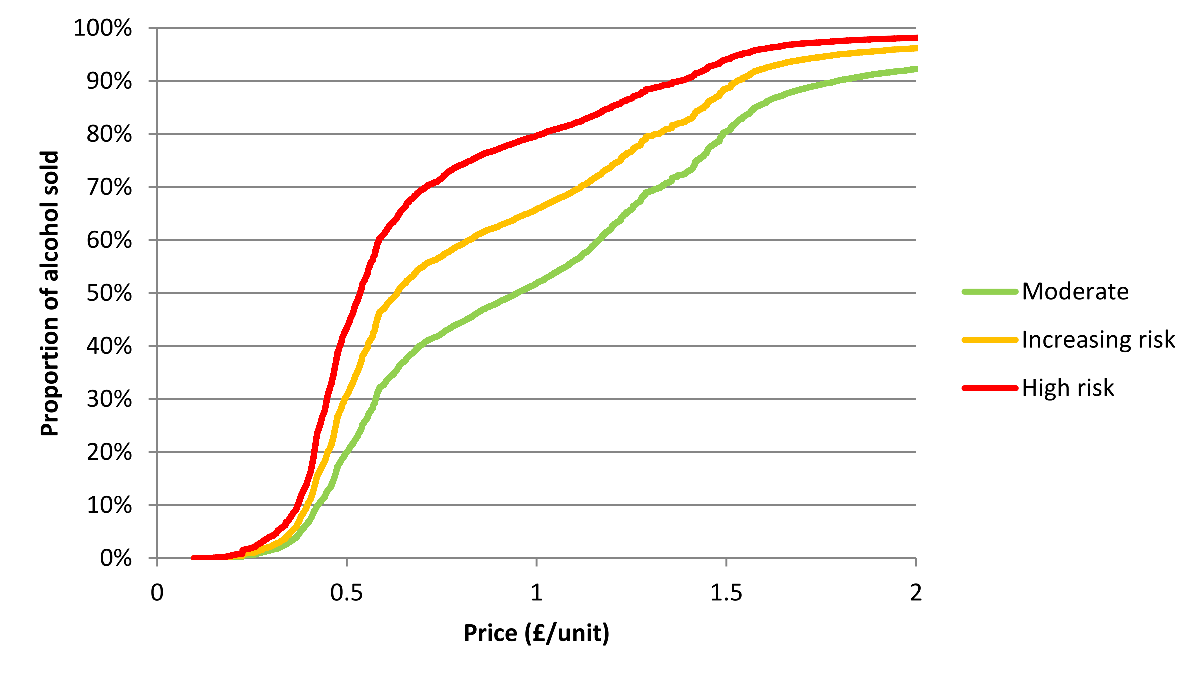


Table 3.1 shows the proportion of alcohol within each category sold below several price thresholds. Although SAPM works on subgroup-specific price distributions, these figures provide an approximation of the overall proportion of alcohol within each category which would be affected by differing levels of MUP. It is apparent that these policies have a minimal impact on on-trade prices and mainly target off-trade prices.

Table 3.1 - Proportion of alcohol sold below selected thresholds

	Proportions sold below thresholds (2014 prices)		
	45p	50p	55p
Off-trade beer	48.5%	65.4%	77.2%
Off-trade cider	68.8%	75.8%	80.4%
Off-trade wine	23.5%	38.5%	53.0%
Off-trade spirits	40.6%	60.8%	71.5%
Off-trade RTDs	0.2%	0.8%	2.4%
On-trade beer	0.2%	0.4%	0.4%
On-trade cider	0.0%	0.3%	1.9%
On-trade wine	0.5%	0.9%	1.6%
On-trade spirits	0.1%	0.1%	0.1%
On-trade RTDs	0.0%	0.0%	0.2%

The price data in Figure 3.3 and Table 3.1 are for the whole adult population; however, purchasing behaviour varies across both the drinking and income spectra. Figure 3.4 shows the proportion and quantity of each drinker groups' standard drinks which would be affected by a 50p MUP stratified by income quintile. It shows that those with the lower incomes purchase a greater proportion of their alcohol, both relatively and absolutely, below 50p per unit at each level of drinking. It also shows that high risk drinkers purchase significantly more of their alcohol below this threshold than moderate drinkers (55% vs. 28% for those in the lowest income quintile and 31% vs. 11% for those in the highest). This indicates that low income drinkers will be more affected by MUP than those on higher incomes and that high risk drinkers will be more affected than moderate drinkers at all levels of income.

Figure 3.4 - Number and proportion of units purchased below 50p by drinker group and income quintile (LCFS 2001-2009 & Nielsen 2012)

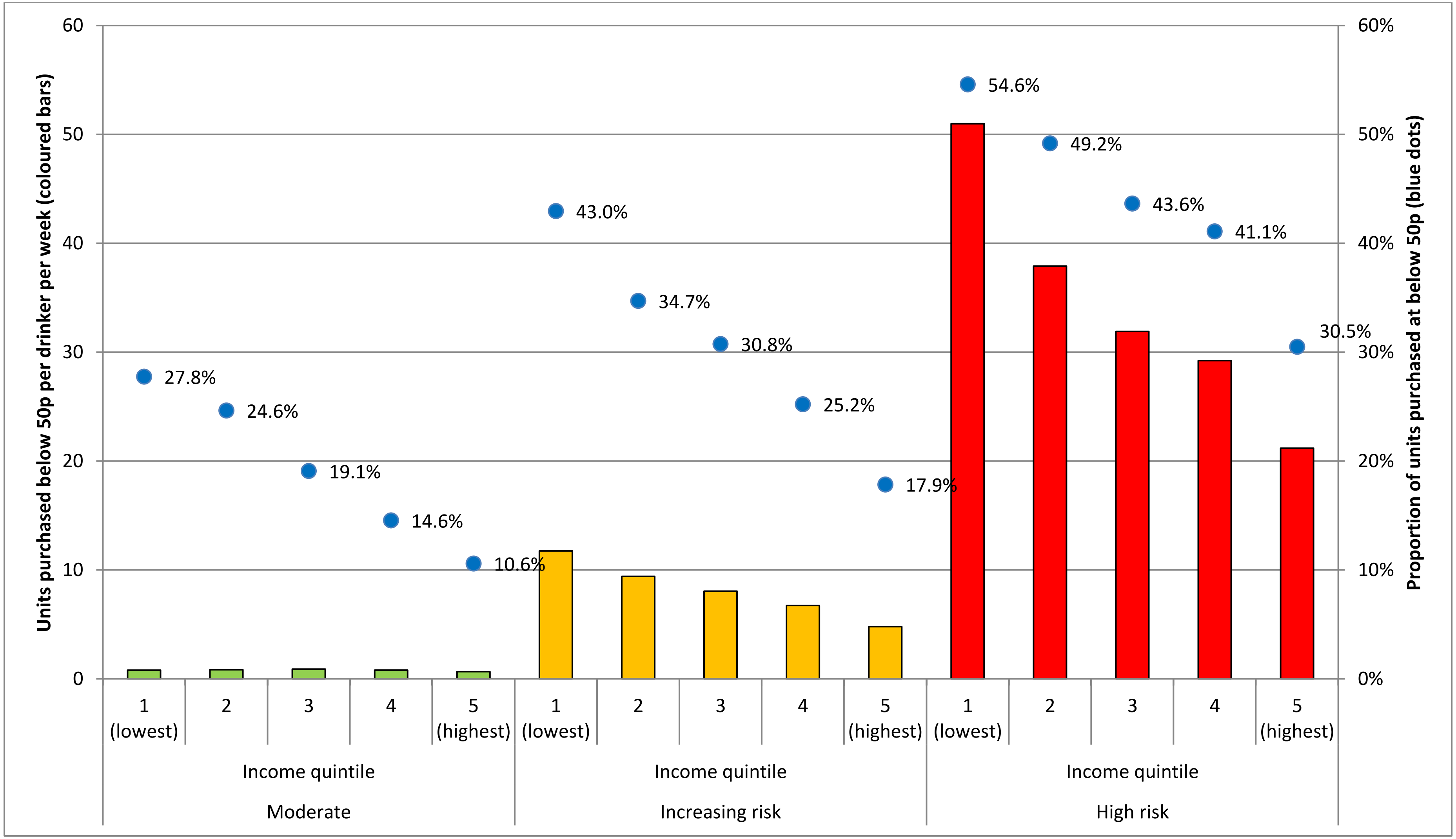
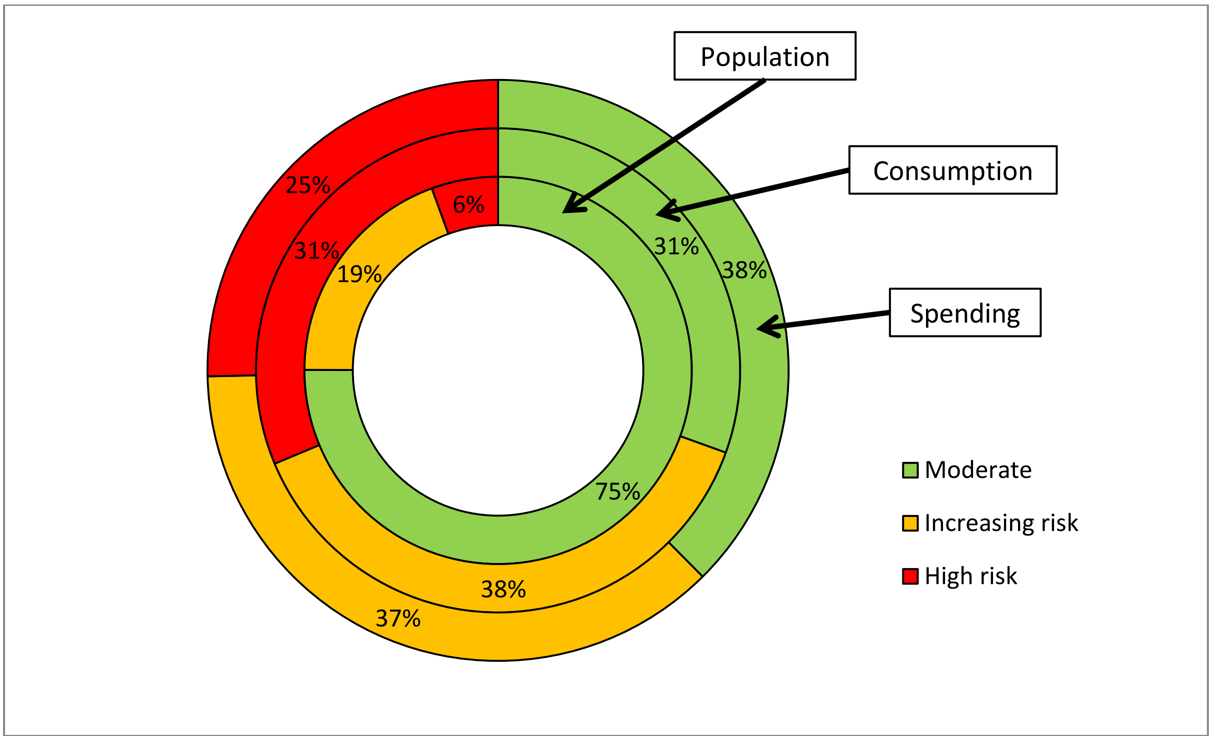


Figure 3.5 illustrates the proportion of total alcohol consumption and total spending on alcohol attributable to each drinker group. It shows that whilst increasing risk and high risk drinkers constitute only 25% of all drinkers (21% of the total adult population), they consume 70% of all alcohol and account for 62% of spending on drink.

Figure 3.5 - Proportion of total consumption and spending by drinker group



3.2.5 Prices elasticities of alcohol demand

The Sheffield Alcohol Research Group have recently utilised the LCFS data described in Section 3.2.4, for the whole of the UK including England, Scotland, Wales and NI (N=227,933 transactions) to provide new estimates of the price elasticities of demand for alcohol. Full details of this model have been described elsewhere (11).

Table 3.2 summaries the key result of this econometric analysis as a 10x10 elasticity matrix, with values on the diagonal representing own-price elasticities and remaining values representing cross-price elasticities. Elasticities are available for 10 categories of beverage: beer, cider, wine, spirits, and RTDs, split by off-trade (e.g. supermarkets) and on-trade (e.g. pubs). For example, the estimated own-price elasticity for off-trade beer is -0.98, indicating the demand for off-trade beer is estimated to reduce by 9.8% when the price of off-trade beer is increased by 10%, all other things being equal. The estimated cross-price elasticity of demand for on-trade wine with regard to off-trade beer price is 0.25, indicating the demand for on-trade wine increases by 2.5% when the price for off-trade beer is increased by 10% (i.e. a substitution effect).

Table 3.2 - Estimated beverage-specific price elasticities of demand for the UK

		Purchase									
		Off-beer	Off-cider	Off-wine	Off-spirits	Off-RTDs	On-beer	On-cider	On-wine	On-spirits	On-RTDs
Price	Off-beer	-0.980*	-0.189	0.096	-0.368	-1.092	-0.016	-0.050	0.253	0.030	0.503
	Off-cider	0.065	-1.268*	0.118	-0.122	-0.239	-0.053	0.093	0.067	-0.108	-0.194
	Off-wine	-0.040	0.736*	-0.384*	0.363	0.039	-0.245	-0.155	0.043	-0.186	0.110
	Off-spirits	0.113	-0.024	0.163	-0.082	-0.042	0.167	0.406	0.005	0.084	0.233
	Off-RTDs	-0.047	-0.159	-0.006	0.079	-0.585*	-0.061	0.067	0.068	-0.179*	0.093
	On-beer	0.148	-0.285	0.115	-0.028	0.803	-0.786*	0.867	1.042*	1.169*	-0.117
	On-cider	-0.100	0.071	0.043	0.021	0.365	0.035	-0.591*	0.072	0.237*	0.241
	On-wine	-0.197	0.094	-0.154	-0.031	-0.093	-0.276	-0.031	-0.871*	-0.021	-0.363
	On-spirits	0.019	-0.117	-0.027	-0.280	-0.145	-0.002	-0.284	0.109	-0.890*	0.809*
	On-RTDs	0.079	0.005	-0.085	-0.047	0.369	0.121	-0.394	-0.027	-0.071	-0.187

Remarks *: p-value <0.05

3.2.6 Modelling the impact of MUP on consumption

In order to estimate the impact of a price-based intervention such as MUP on alcohol consumption it is first necessary to estimate the effect of the policy on the beverage-specific price distributions described in Section 3.2.4. As in all previous analysis of MUP policies using SAPM, we assume that all prices below the MUP threshold are raised to the level of the threshold. This assumption is highly likely to be conservative, as it is likely that, in reality, the supply-side response to an MUP policy would be to increase the prices of some items beyond the threshold, whilst also increasing the prices of other products which are not currently being sold below the threshold in order to maintain some degree of price differentiation. As a result, the observed price changes are likely to exceed those modelled here, with correspondingly higher reductions in consumption and impacts on model outcomes.

After adjusting the price distributions, the final step to estimating the impact of the intervention on alcohol consumption is to apply the price elasticities discussed in Section 3.2.5. For each modelled subgroup the impact of the change in prices caused by the policy on mean weekly alcohol consumption is estimated using the elasticity matrix described in Table 3.2. The formula used to apply the elasticity matrix is shown below:

$$\%\Delta C_i = (1 + e_{ii}\%\Delta p_i)(1 + \sum_{j\neq i}^{\forall j} e_{ij}\%\Delta p_j) - 1 \qquad \textit{Equation 1}$$

where, $\%\Delta C_i$ is the estimated percentage change in consumption for beverage i, e_{ii} is the own-price elasticity for beverage i, $\%\Delta p_i$ is the percentage change in price for beverage i, e_{ij} is the cross-price elasticities for the consumption of beverage i due to a change in the price of beverage j, and $\%\Delta p_j$ is the percentage change in price for beverage j.

As described in Section 3.5.4.3, the estimated relative change in weekly consumption for each individual is then used to predict the change in drinking patterns for the individual. Note that we assume that real-terms prices remain unchanged (in the baseline year (2014) and all subsequent years) except for the changes outlined here.

3.3 Modelling the relationship between national IBA policies in primary care and consumption

3.3.1 Overview

The Sheffield Alcohol Policy Model has previously been used to estimate the impact of IBAs in primary care across the whole adult population, finding that programmes of assessing patients for risky drinking at either their next GP registration or at their next GP consultation would be both cost-saving and health improving in the long-term (4,12). These results were produced using a previous version of SAPM (v2.0) and these results have therefore been updated to incorporate the new data and methodological advances included in SAPM3.

Previous analyses have examined the impact of two alternative policies:

- All adult patients are screened when they next register with a new GP (next registration)
- All adult patients are screened when they next visit their GP (next consultation)

For the present report these scenarios were revisited, however these scenarios assume 100% uptake among GPs, that is to say they assume that every eligible patient will receive an IBA. There is good evidence to suggest that this is a substantial overestimation of current practice in the UK (13,14) and we therefore also examined the impact of 10%, 20%, 30% or 40% of next GP consultations involving IBA in order to explore the marginal impact of increasing uptake from the current, low, levels.

For all of these policy options we model the impact of implementation for 10 years, assuming that no patients will receive multiple IBAs.

3.3.2 Baseline population

In modelling national IBA policies we use the same baseline population as we use for the MUP modelling described in Section 3.2.2 (i.e. respondents to the 2012 HSE).

3.3.3 Population coverage

The proportion of the baseline population who would receive an IBA in each year of the modelled 10 year implementation period for each policy is taken from previously published figures based on GP records and internal migration data (4). In order to estimate the proportions of the population receiving an IBA where uptake is assumed to be less than 100%, the published data is combined with consultation-level data obtained from the LINH database in the Netherlands (15) on the number of consultations per patient per year over 5 years from 2006-2010. Whilst the use of English data would be preferable, this was not available, however available evidence suggests that the primary care contexts and consultation frequencies are very similar between the UK and the Netherlands (16). When modelling partial uptake the assumption is made that an uptake rate of x% means that on any eligible consultation (i.e. with an adult patient who has not previously received an IBA) there is a probability of x% that the patient will receive an IBA.

3.3.4 Identification

Current NICE guidance for the prevention of harmful drinking recommends patients are assessed using the AUDIT questionnaire (2). We assume all eligible patients are asked the first question of AUDIT ("How often do you have a drink containing alcohol?"). Those who answer "Never" are not asked any further questions, with all other patients being asked the remaining questions from the full AUDIT, with a total score of 8+ indicating that the individual's drinking is at risk of negatively impacting on their health.

For each modelled individual receiving an IBA, their probability of identification at each stage is estimated from a logistic regression model fitted on data from the Adult Psychiatric Morbidity Survey from the years 2000 and 2007. This model estimates the probability of screening positive given the individual's age, gender and mean level of alcohol consumption. All eligible individuals are then assigned to either being positively or negatively identified based on these probabilities.

3.3.5 Brief Advice

All patients identified as being at risk are assumed to receive brief advice from their GP in line with NICE guidelines on the prevention of harmful drinking (2). This is assumed to last 5 minutes, following which the individual receiving the brief advice is modelled to reduce their alcohol consumption by 12.3% in the following year. This figure is taken from the latest Cochrane review of brief advice in primary care (17), which shows that those receiving brief advice reduce their alcohol consumption (compared to those in the control arms of the relevant trials) by an average of 38.4g (of pure ethanol) from a mean pre-intervention level of 313g.

There is limited evidence on the impact on alcohol consumption in the longer-term; however results from a randomised controlled trial showed some residual effect at 4 years (18). Modelling this reduction as linear suggests that individuals' consumption will return to pre-intervention levels after 7 years. We have previously tested the impacts of alternative, more pessimistic, assumptions around effectiveness and duration of effect for population-level IBA programmes, suggesting that they are unlikely to change the overall results.

3.3.6 IBA costs

The direct costs of implementing IBA are calculated based on the assumption that Identification is conducted by a practice nurse, while any indicated Brief Advice sessions are delivered by a GP, which represents a common model of IBA as implemented in primary care in England. Alternative assumptions about delivery staff have been shown previously to have little bearing on the model results (12). Estimates of screening duration for each screening tool are used to estimate the total time taken up by the IBA process for each individual (4). Published estimates of the per-minute cost of the practice nurse and GP's patient contact time are then used to calculate the total cost of delivering IBAs across the eligible population (19).

3.4 Modelling the relationship between inclusion of IBA within NHS Health Checks and consumption

3.4.1 Overview

In addition to modelling IBAs as a part of routine primary care registrations and consultations, we have also modelled the impact of including IBAs within the NHS Health Checks for patients aged 40-74. This model utilises the same structure as the national policies described in Section 3.3, with a number of key differences outlined below.

The NHS Health Checks programme is a "Risk assessment and management programme to prevent or delay the onset of diabetes, heart and kidney disease and stroke" (20). Individuals are eligible to receive a health check if they are aged 40-74 and do not have a pre-existing diagnosis of coronary heart disease, chronic kidney disease, diabetes, hypertension, atrial fibrillation, transient ischaemic attack, hypercholesterolaemia, heart failure, peripheral arterial disease or stroke, are not currently being prescribed statins and who have not previously been identified as having a high risk of developing cardiovascular disease (20).

3.4.2 Baseline population

We again use the 2012 Health Survey for England (HSE) as our baseline population. Respondents are considered to be eligible for a Health Check if they are aged between 40 and 74 and do not report:

- That they are currently being treated for hypertension
- That they have ever been told by a nurse or doctor that they have hypertension
- That they have ever been told by a doctor that they have diabetes
- That they currently have diabetes, stroke, cerebral haemorrhage, heart attack, angina, hypertension or other heart problems
- That they are currently being prescribed statins.

These criteria represent the best match to the Health Check availability criteria which can be constructed from the HSE data and result in the exclusion of 35.8% of 40-74 year olds from the model, a figure which is comparable to PHE's estimates of 31.5% of 40-74 year olds being ineligible (21). Table 3.3 illustrates the proportion of HSE respondents excluded on the basis of each of these criteria.

Table 3.3 - Health Checks eligibility criteria (HSE 2012)

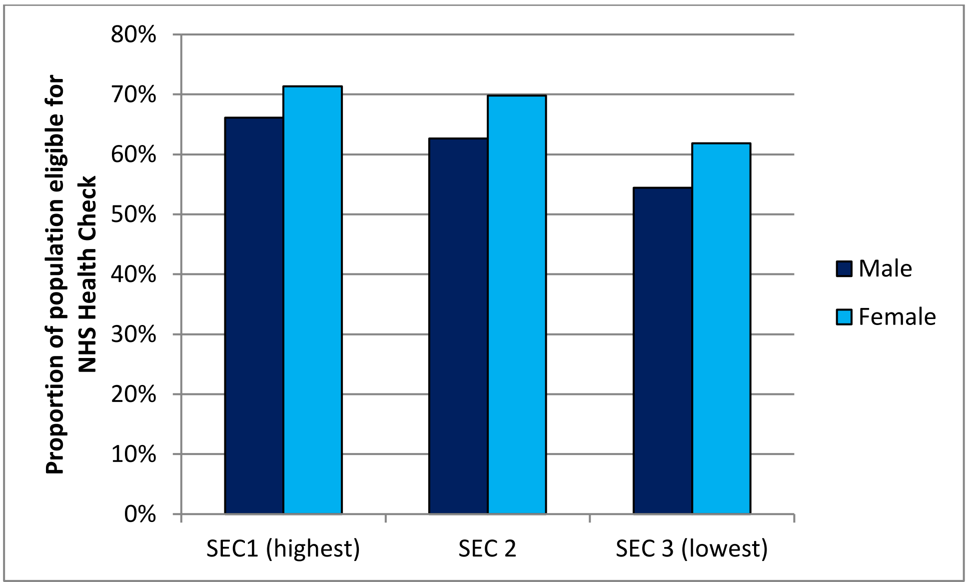
	Proportion of population ineligible for Health Check		
	Male	**Female**	**Population**
Currently being treated for hypertension	19.2%	17.2%	18.1%
Ever been told by nurse of doctor that have hypertension	30.0%	26.5%	28.2%
Ever been told by a doctor that have diabetes	9.1%	6.7%	7.9%
Currently have diabetes, stroke, cerebral haemorrhage, heart attack, angina, hypertension or other heart problems	18.7%	13.3%	16.0%
Currently being prescribed statins	21.5%	13.5%	17.5%
Any of the above	38.9%	32.7%	35.8%

Table 3.4 presents some descriptive characteristics of the English population aged 40-74, stratified by eligibility for the NHS Health Checks based on these criteria. This shows that ineligible patients are older on average and tend to drink less than eligible patients. There are also important inequalities in eligibility, with a greater proportion of individuals in lower socioeconomic groups being ineligible to receive the health checks. This is illustrated clearly in Figure 3.6.

Table 3.4 - Descriptive characteristics of patients eligible for Health Checks (HSE 2012)

	Mean age		**Mean weekly alcohol consumption (units)**		**Distribution of socioeconomic status**		
	Male	**Female**	**Male**	**Female**	**SEC1 (highest)**	**SEC 2**	**SEC 3 (lowest)**
Eligible population	51.9	52.4	17.3	9.4	41%	27%	32%
Ineligible population	58.9	59.5	15.6	8.7	34%	24%	42%

Figure 3.6 - Socioeconomic inequalities in eligibility for NHS Health Checks (HSE 2012)



Every local authority in England is required to invite each eligible person once every five years, although local authorities are free to choose how they wish to achieve this. We therefore model a single 'cycle' of 5 years in which all eligible people are invited once, with the assumption that 20% of this population being invited each year.

3.4.3 Uptake of Health Checks

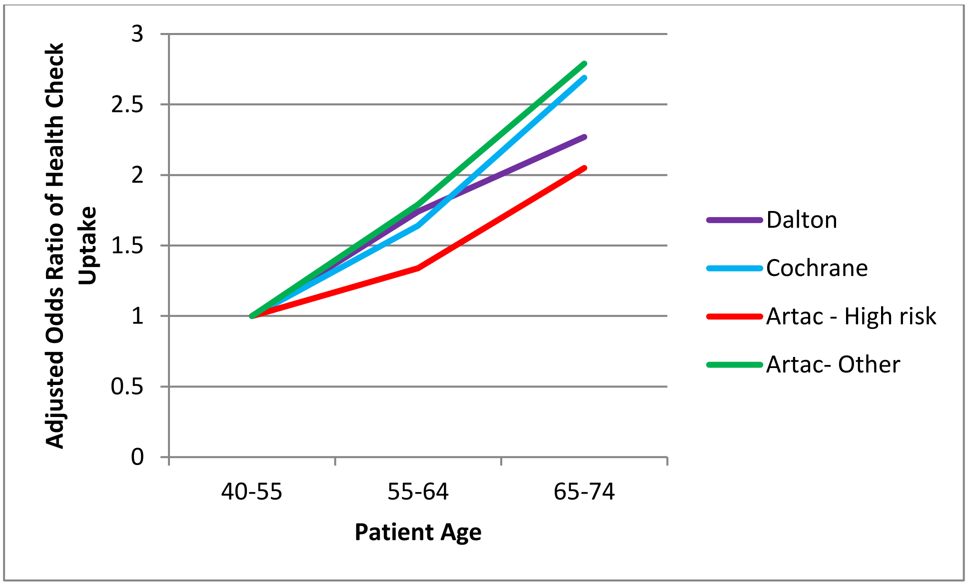
Although all eligible patients are invited for a health check, not all will take up this invitation and the current uptake rate is 48.0% (21). Variation in this uptake rate between different age, gender and socioeconomic groups, as well as at different levels of alcohol consumption, would have important implications for the estimated impact of the Health Check IBAs on population health. We have identified 3 existing studies which have examined differential uptake rates according to these factors:

- Cochrane et al examined differential uptake by gender, age group and deprivation tertile in Stoke-on-Trent in 2009-2010 (22)

- Dalton et al looked at differential uptake by gender and age group combined in Ealing, London in 2008-2010 (23)
- Artac et al explored differential uptake by gender, age group and deprivation tertile in Hammersmith and Fulham, London in 2009-2011 (24)

All three of these studies find consistent age effects, with patients aged 65-74 being over twice as likely to take up an invitation as those aged 40-55. These results are summarised in Figure 3.7. As this conclusion is consistent across all 3 studies we use the results from Dalton et al, which was the only study to present results by both age and gender combined.

Figure 3.7 - Differential uptake rates by age in published studies



Whilst both Cochrane et al and Artac et al examined differences in uptake rate by deprivation tertile, they find contrasting effects, with Cochrane showing that people in less deprived areas have higher uptake rates and Artac reporting that those in the most deprived areas have higher uptake. These gradients are shown in Table 3.5. We have also analysed data published by PHE on the uptake rates by local authority (21). This data shows that, after controlling for differences in age and gender, local authorities with a higher proportion of their population living in the 20% of most deprived Lower Super Output Areas have higher uptake rates (a 1% increase in this proportion corresponds to a 2.8% increase in uptake rates, although this coefficient is not significant (p=0.62)). This analysis cannot show, however, whether the increased uptake is actually amongst those living in the deprived areas.

Table 3.5- Socioeconomic gradients in uptake rates from published studies

Study	Adjusted odds ratios of uptake		
	Most deprived	Intermediate	Least deprived
Cochrane et al	1	1.12	1.25
Artac et al – High risk	1	0.94	0.84
Artac et al - Other	1	0.84	0.80

In view of the conflicting nature of this evidence our baseline assumption is that uptake rates are equal across socioeconomic groups. We test this assumption by using data from Cochrane et al and

Artac et al in a pair of sensitivity analyses in which we apply the corresponding gradient from Table 3.5 to the age-gender uptake rates taken from Dalton et al.

Unfortunately no evidence could be identified on differential uptake by levels of alcohol consumption and it is therefore assumed that the probability of taking up an invitation to attend a health check is independent of current drinking. In order to investigate the possible impact of this assumption, an illustrative sensitivity analysis we explore the impact on the overall model results if we assume moderate drinkers are 10% more likely and high risk drinkers 10% less likely than average to take up an invitation.

As part of the Health Checks programme, local authorities have a commitment to seek continuous improvement in the uptake rates. In order to explore the potential benefits of improving the current uptake rate we also examine the impact of increasing uptake rates to 66% and 75% in line with PHE targets.

3.4.4 Identification

In line with best practice guidance all patients attending an NHS Health Check are assumed to receive an alcohol risk assessment using the AUDIT questionnaire. The guidance suggests using an initial screening tool, either AUDIT-C (with a threshold of 5+) or FAST (with a threshold of 3+), both of which consist of a subset of the questions from the full AUDIT. Patients screening positively on this initial screen are then asked the remaining questions from the full AUDIT, with a total score of 8+ indicating that the individual's drinking is at risk of negatively impacting on their health.

There is some evidence to suggest that the use of AUDIT/AUDIT-C is more common in England than FAST (13) and we therefore model a screening pathway in which all patients who attend a health check are screened with AUDIT-C, followed by the full AUDIT for those scoring 5+ on the initial screen. Patients responding that they do not drink to the first question of AUDIT-C are assumed not to be asked any further questions. All patients scoring 8+ on the full AUDIT are modelled to receive Brief Advice. We test the impact of different screening tools through a pair of sensitivity analyses in which we model the impact of using a FAST initial screen followed by the full AUDIT and the use of the AUDIT-C alone.

As described in Section 3.3.4, the probability of identification at each stage is estimated from a logistic regression model fitted on data from the Adult Psychiatric Morbidity Survey from the years 2000 and 2007.

3.4.5 IBA costs

For the purposes of costing it is assumed that Health Checks are delivered by practice nurses, whose time in delivering IBA is costed using published per-minute estimates for patient contact time (19). Assuming instead that Health Checks are delivered by GPs has no bearing on the overall model results and is not reported here. Note that we consider only the cost of the staff time spend delivering the IBA and not the overall Health Check and the counterfactual in all cost-effectiveness analysis is that Health Checks continue, but without any IBA component.

3.4.6 Sensitivity analyses

As discussed above, we have conducted a range of sensitivity analyses in order to investigate the impact of both uncertainty in key model inputs and also explore the impact of alternative implementation options. These sensitivity analyses are summarised in Table 3.6.

Table 3.6 - Overview of model sensitivity analyses

Description			Scenario
		Baseline assumptions	A
Alternative modelling assumptions	Socioeconomic gradient in uptake	Lower socioeconomic groups less likely to take up invitation	B
		Lower socioeconomic groups more likely to take up invitation	C
	Consumption gradient in uptake	Heavier drinkers less likely to take up invitation	D
	More pessimistic estimates of effect of IBA	Brief Advice less effective (5.9%)	E
		Effect of Brief Advice lasts less long (3 years)	F
		Brief Advice less effective and effect lasts less long (5.9% & 3 years)	G
Alternative implementation scenarios	Alternative identification tools	Attendees screened with AUDIT-C only (5+)	H
		Attendees screened with FAST (3+) followed by AUDIT (8+)	I
	Increased uptake rate	66% uptake rate of Health Check invitations	J
		75% uptake rate of Health Check invitations	K

3.5 Modelling the relationship between consumption and harm

3.5.1 Model structure

An epidemiological approach is used to model the relationship between consumption and harm, relating changes in alcohol consumption to changes in the risk of experiencing harmful outcomes. Risk functions relating consumption (however described) to level of risk are a fundamental component of the model.

The 'consumption to harm' model considers the impact of consumption on harms in three domains: health (including the impact on both mortality and morbidity), crime and the workplace.

3.5.2 Alcohol-related health conditions

The model aims to capture the policy impact for the large number of health conditions for which evidence suggests alcohol plays a contributory role. Table 3.7 presents a list of all conditions included in the model, which has been adapted from recent global meta-analyses and burden of disease studies (25,26). These conditions are divided into four categories of attribution:

1) Wholly attributable chronic – meaning that the harm cannot occur in the absence of alcohol consumption, and risk of occurrence changes with chronic exposure to alcohol (e.g. alcoholic liver disease, ICD10 code = K70).
2) Wholly attributable acute – meaning that the harm cannot occur without alcohol consumption, and risk of occurrence changes with acute exposure to alcohol including intoxication (e.g. Ethanol poisoning, ICD10 code = T51.0).
3) Partially attributable diseases – meaning that the harm can occur without alcohol but the risk of occurrence changes with chronic exposure to alcohol (e.g. malignant neoplasm (cancer) of the oesophagus, ICD10 code = C15). There are three conditions within this category – ischaemic heart disease, ischaemic stroke and type II diabetes – in which alcohol may have an overall protection effect.
4) Partially attributable injuries – meaning that the harm can occur without alcohol but the risk of occurrence changes with acute exposure to alcohol (e.g. falls, ICD10 code = W00-W19, or assault, ICD10 = X85-Y09).

Table 3.7 - Health conditions included in the model

Main category	Sub category	Disease or injury	ICD-10 codes	Source of dose-response relative risk functions
Wholly attributable to alcohol (17)	Chronic (10)	Alcohol-induced pseudo-Cushing's syndrome	E24.4	By definition AAF=1 and no defined relative risk functions – see Section 3.5.4.1
		Degeneration	G31.2	
		Alcoholic polyneuropathy	G62.1	
		Alcoholic myopathy	G72.1	
		Alcoholic cardiomyopathy	I42.6	
		Alcoholic gastritis	K29.2	
		Alcoholic liver disease	K70.0-K70.4, K70.9	
		Acute pancreatitis (alcohol induced)	K85.2	
		Chronic pancreatitis (alcohol induced)	K86.0	
		Maternal care for (suspected) damage to foetus from alcohol	O35.4	
	Acute (7)	Mental and behavioural disorders due to use of alcohol	F10	
		Excessive Blood Level of Alcohol	R78.0	
		Toxic effect of alcohol	T51.0, T51.1, T51.8, T51.9	
		Accidental poisoning by exposure to alcohol	X45	
		Intentional self-poisoning by and exposure to alcohol	X65	
		Poisoning by and exposure to alcohol, undetermined intent	Y15	
		Evidence of alcohol involvement determined by blood alcohol level	Y90	
Partially attributable to alcohol (23)	Diseases (overall detrimental) (14)	Tuberculosis	A15-A19, B90	(27)
		Malignant neoplasm of lip, oral cavity and pharynx	C00-C14	(28)
		Malignant neoplasm of oesophagus	C15	(29)
		Malignant neoplasm of colon and rectum	C18-C21	(30)
		Malignant neoplasm of liver and intrahepatic bile ducts	C22	(31)
		Malignant neoplasm of larynx	C32	(32)
		Malignant neoplasm of breast	C50	(33)
		Epilepsy and status epilepticus	G40-G41	(34)
		Hypertensive diseases	I10-I14	(35)
		Cardiac arrhythmias	I47-I48	(36)
		haemorrhagic and other non-ischaemic stroke	I60-I62, I69.0-I69.2	(37)
		Lower respiratory infections: pneumonia	J09-J22, J85, P23	(38)
		Cirrhosis of the liver (excluding alcoholic liver disease)	K70 (excl. K70.0-K70.4, K70.9), K73-K74	(39)
		Acute and chronic pancreatitis	K85-K86 excl. K85.2, K86.0	(40)
	Injuries (9)	Transport injuries (including road traffic accidents)	V01-V98, Y85.0	(41)
		Fall injuries	W00-W19	
		Exposure to mechanical forces (including machinery accidents)	W20-W52	
		Drowning	W65-W74	
		Other Unintentional Injuries	W75-W99, X30-X33, X50-X58	
		Accidental poisoning by exposure to noxious substances	X40-X49 excl. X45	
		Intentional self-harm	X60-X84, Y87.0 excl. X65	
		Assault	X85-Y09, Y87.1	
		Other intentional injuries	Y35	
Diseases (overall protective) (3)		Diabetes mellitus (type II)	E10-E14	(42)
		Ischaemic heart disease	I20-I25	(43)
		Ischaemic stroke	I63-I67, I69.3	(37)

3.5.3 Alcohol-attributable fractions and potential impact fractions

The methodology is similar to that used in Gunning-Scheper's Prevent model (44), being based on the notion of the alcohol-attributable fraction (AAF) and its more general form, the potential impact fraction (PIF).

The AAF of a disease can be defined as the difference between the overall average risk (or incidence rate) of the disease in the entire population (drinkers and never-drinkers) and the average risk in those without the exposure factor under investigation (never-drinkers), expressed as a fraction of the overall average risk. For example, the AAF for female breast cancer is simply the risk of breast cancer in the total female population minus the risk of breast cancer in women who have never consumed alcohol, divided by the breast cancer risk for the total female population. Thus, AAFs are used as a measure of the proportion of the disease that is attributable to alcohol. While this approach has traditionally been used for chronic health-related outcomes, it can in principle be applied to other harms (including those outside of the health domain).

The AAF can be calculated using the following formula:

$$AF = \frac{\sum_{i=1}^{n} p_i (RR_i - 1)}{1 + \sum_{i=1}^{n} p_i (RR_i - 1)}$$

Equation 2

where, *RRi* is the relative risk (RR) due to exposure to alcohol at consumption state *i*, *pi* is the proportion of the population exposed to alcohol at consumption state *i*, and *n* is the number of consumption states.

If the reference category is abstention from alcohol then the AAF describes the proportion of outcomes that would not have occurred if everyone in the population had abstained from drinking. Thus the numerator is essentially the excess expected cases due to alcohol exposure and the denominator is the total expected cases. In situations where certain levels of alcohol consumption reduce the risk of an outcome (e.g. coronary heart disease) the AAF can be negative and would describe the additional cases that would have occurred if everyone was an abstainer.

Note that there are methodological difficulties with AAF studies. One problem is in defining the non-exposed group – in one sense 'never drinkers' are the only correct non-exposed group, but they are rare and usually quite different from the general population in various respects. However, current non-drinkers include those who were heavy drinkers in the past (and these remain a high-risk group, especially if they have given up due to alcohol-related health problems). Several studies show that findings of avoided coronary heart disease risk may be based on systematic errors in the way abstainers were defined in the underlying studies (45).

The PIF is a generalisation of the AAF based on arbitrary changes to the prevalence of alcohol consumption (rather than assuming all drinkers become abstainers). Note that a lag may exist between the exposure to alcohol and the resulting change in risk. The PIF can be calculated using the following formula:

$$PIF = 1 - \frac{\sum_{i=0}^{n} \overline{p_i} RR_i}{\sum_{i=0}^{n} p_i RR_i}$$

Equation 3

where $\overline{p_i}$ is the modified prevalence for consumption state *i* and state 0 corresponds to abstention. In the model, alcohol consumption in a population subgroup is described non-parametrically by the associated observations from the SHeS. For any harmful outcome, risk levels are associated with consumption level for each of the observations (note that these are not person-level risk functions). The associated prevalence for the observation is simply defined by its sample weight from the survey. Therefore, the PIF is implemented in the model as:

$$PIF = 1 - \frac{\sum_{i=0}^{N} w_i \overline{RR_i}}{\sum_{i=0}^{N} w_i RR_i}$$

Equation 4

where w_i is the weight for observation *i*, $\overline{RR_i}$ is the modified risk for the new consumption level and *N* is the number of samples.

3.5.4 Applying potential impact fractions

The impact of a change in consumption on health harms was examined using the potential impact fraction framework and by three different methods for implementation:

1. Direct application of consumption measures to calculate potential impact fractions for wholly attributable chronic and acute conditions.
2. Relative risk functions from the published literature for partial attributable chronic diseases.
3. Relative risk functions from the published literature and derived individual annualised risk for partial attributable injuries.

3.5.4.1 Wholly attributable chronic and acute conditions

As wholly attributable chronic and acute conditions, by definition, have an AAF=1 and therefore relative risk cannot be defined, the relative risk term in Equation 4 is replaced with alcohol consumption that is likely to lead to increased risk for the health condition, denoted by $RiskAlc_i$. For wholly attributable chronic conditions, $RiskAlc_i$ is defined as the difference between mean daily consumption and recommended daily consumption in the UK (3/2 units for men/women) or 0 if mean daily consumption is below the threshold. For wholly attributable acute conditions, $RiskAlc_i$ is defined the difference between peak day consumption and the cut-off thresholds of 4/3 units for men/women at which we assume the acute risk starts to increase or 0 if peak day consumption is below the threshold.[1]

3.5.4.2 Partially attributable chronic conditions

The relative risk functions for all chronic conditions that are partially attributable to alcohol are taken from published meta-analyses and used in Equation 4. Table 3.7 gives the sources for these risk functions. Ischaemic heart disease (IHD) represents a special case in SAPM3 as it is the only condition where a literature-based risk function is adjusted to reflect additional evidence. The source for the main risk functions suggests drinking up to approximately 8 units a day for males and 4 units a day for females is associated with reduced risk of IHD relative to abstainers (43). However, an earlier study by the same authors finds this reduced risk is substantially attenuated or eliminated for those engaging in heavy episodic drinking (defined as consuming at least 7.5 units on a single day) at least once a month (46). As the present analysis does not consider frequency of heavy episodic drinking, this additional evidence is incorporated using a method employed by Shield et al. (47) whereby any protective effect is removed (i.e. Relative Risk is assumed to be at least 1) for any drinkers who consume more than 7.5 units per day on average (52.5 units per week). This limited adjustment means cardioprotective effects are likely to be overestimated within the model as many individuals with mean consumption less than 7.5 units per day are likely to be drinking this amount at least once a month.

3.5.4.3 Partially attributable acute conditions

Partially attributable acute conditions include various traffic and non-traffic injuries. The identified relative risk functions for these conditions are different from the relative risk functions for partially attributable chronic conditions and cannot be used directly in Equation 4. The input and outcome of the relative risk functions for partially attributable chronic conditions are usual alcohol consumption and relative risk over a certain period of time, however, the input and outcome of the identified relative risk functions for traffic and non-traffic injuries are levels of drinking on the occasion prior to the injury and the relative risk for the drinking occasion (41). As SAPM3 works on annual cycles, relative risk in Equation 4 is defined as annual relative risk. Therefore, to apply Equation 4, single drinking occasion based relative risk needs to be converted to long-term (e.g. annual) relative risk of an individual in the survey.

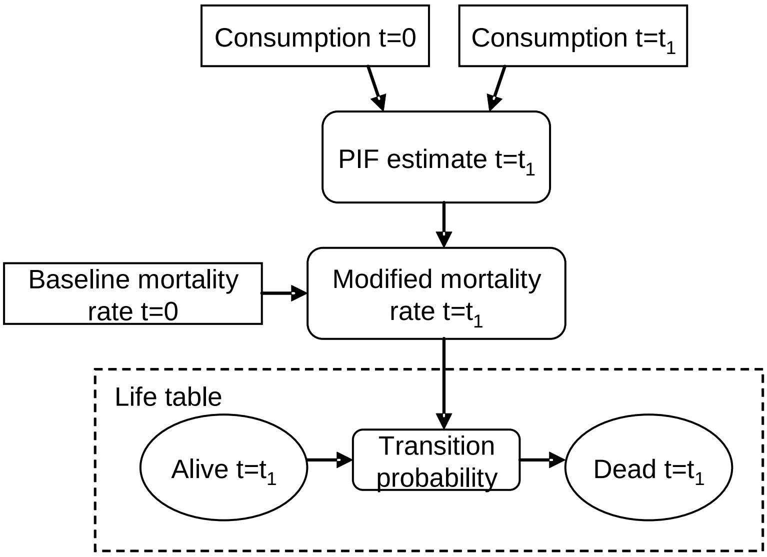
A new method to estimate annualised relative risk of alcohol-attributable traffic- and non-traffic injuries has been developed. Briefly, three measures are defined to represent drinking pattern based on single drinking occasions which are the frequency of drinking occasions (defined as n, or number of drinking occasions per week), mean level of alcohol consumption for a given drinking occasion (defined as μ, or units of alcohol) and the variability of alcohol consumption for a given drinking occasion (defined as σ, or standard deviation of units of alcohol consumed in drinking occasions). Using the ONS' National Diet and Nutrition Survey (NDNS), regression models were fitted to relate the three measures with mean consumption and a range of independent variables (e.g. age, gender, education, ethnicity, etc.) (48). These regression models are used to impute the three measures for each individual in the Health Survey for England. For each individual, alcohol consumption on a given drinking occasion is assumed to follow a normal distribution with mean of μ and standard deviation of σ; and the duration of intoxication for a given drinking occasion is calculated by applying the equation for estimating blood alcohol content. Finally, a series of integrations was performed to calculate the annualised relative risk for traffic and non-traffic accidents. Detailed description of the method can be found elsewhere (48,49). The annualised relative risk is used in Equation 4 to estimate the potential impact factor for partially attributable acute conditions.

3.6 Consumption to health harms model

3.6.1 Mortality model structure

A simplified version of the model structure for mortality is presented in Figure 3.8. The model is developed to represent the population of England in a life table. Separate life tables have been implemented for males and females.

Figure 3.8 - Simplified mortality model structure



The life table is implemented as a linked set of simple Markov[3] models with individuals of age *a* transitioning between two states – alive and dead – at model time step *t*. Those of age *a* still alive after the transition then form the initial population for age *a+1* at time *t+1* and the sequence repeats.

The transition probabilities from the alive to dead state are broken down by condition and are individually modified via potential impact fractions over time t, where the PIF essentially varies with consumption over time:

$$PIF_t = 1 - \frac{\sum_{i=1}^{N} RR_{i,t}\, w_i}{\sum_{i=1}^{N} RR_{i,0} w_i}$$

Equation 5

where PIF_t is the potential impact fraction relating to consumption at time *t*, *i* = SHeS sample number, *N* = number of samples in subgroup *i*, $RR_{i,t}$ is the risk relating to the consumption of SHeS sample *i* at time *t*, $RR_{i,0}$ is the risk at baseline, and w_i is the weight of sample *i*.

[3] A state transition model where individuals can exist in a set number of states at any time period and transition between states using a set of transition probabilities which are conditional on the current state of the individual.

Note that the PIF can be decomposed to enable different population groups at baseline – for example, moderate, increasing risk and high risk drinkers or individuals in poverty and not in poverty– to be followed separately over the course of the model.

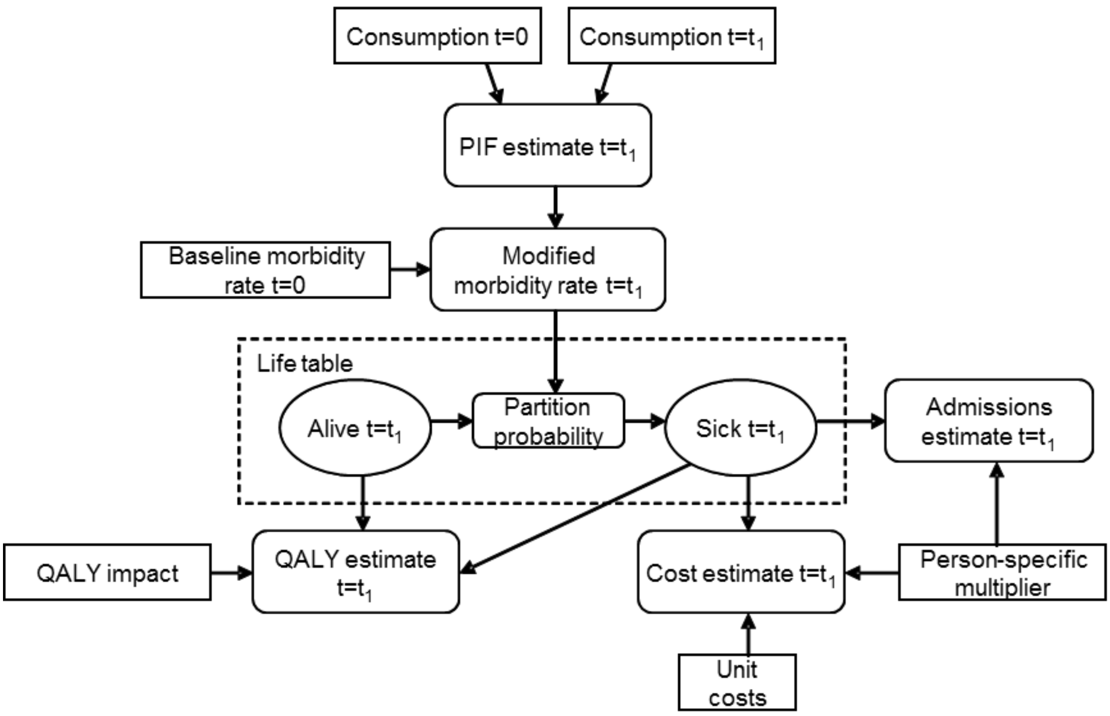
The model computes mortality results for two separate scenarios (a baseline – implemented as 'no change to consumption' in the analysis herein – and an intervention). The effect of the intervention is then calculated as the difference between the life tables of two scenarios, enabling the change in the total expected deaths attributable to alcohol due to the policy to be estimated.

Outcomes from the mortality modelling are expressed in terms of life years saved. Morbidity valuation is the purpose of a second model described below.

3.6.2 Morbidity model structure

A simplified schematic of the morbidity model is shown in Figure 3.9. The model focuses on the expected disease prevalence for population cohorts. Note that if an incidence-based approach were used instead, then much more detailed modelling of survival time, cure rates, death rates and possibly disease progression for each disease for each population subgroup would be required.

Figure 3.9 - Simplified morbidity model structure



The morbidity model works by partitioning the alive population at time *t*, rather than using a transition approach between states as previously described for the mortality model. Alive individuals are partitioned between all 43 alcohol-related conditions (and a 44th condition representing overall population health, not attributable to alcohol).

As in the mortality model, the PIF is calculated based on the consumption distribution at time *0* and *t*. The PIF is then used to modify the partition rate (i.e. the distribution of the 43 conditions for alive individuals) to produce person-specific sickness volumes. These volumes then form the basis for estimating both health service costs and health related quality of life.

Quality Adjusted Life Years (QALYs) are examined using the difference in health-related quality of life (utility) in individuals with alcohol health harms and the quality of life measured in the general population (or “normal health”). Utility scores usually range between 1 (perfect health) and 0 (a state equivalent to death), though it is possible for some extreme conditions to be valued as worse than death. The utility scores are an expression of societal preference for health states with several different methods available to estimate them. Note that because a life table approach has been adopted, the method to estimate QALY change for morbidity also encompasses the mortality valuation.

3.6.3 Time lag effects for chronic harms

When modelling the link between consumption and harm, one important input is the assumption surrounding the ‘time lag’ – the time needed to achieve the full benefit (reduction in harms) associated with a reduction of consumption. Such data is necessary for chronic conditions where the development of diseases often occurs over many years.

Following a recent systematic review by members of the Sheffield Alcohol Research Group (50), SAPM3 incorporates new lag structures for all chronic harms based on the best available published evidence to estimate the temporal relationship between changes in consumption and changes in risk of harm. See Table 2 in Holmes et al. (50) for full details of these relationships as implemented in the model. In line with the findings of this review, health outcomes are reported at 20 years as ‘full effect’, as this is the time at which the full impact of a change in consumption on health will have occurred. Note that this 20 year time horizon for the model means that all outcomes are reported over the 20 years subsequent to the model baseline year (2014). For IBA policies we model 10 years of implementation (or 5 years in the case of Health Checks) and therefore we may be underestimating the total health benefits of the policy, as the true ‘full effect’ may not be experienced until the 30th year following implementation for individuals receiving IBA in year 10.

3.6.4 Mortality model parameters

Baseline population data, split by age and gender, used to populate the initial life tables for England, was obtained from the Office for National Statistics’ (ONS) mid-year population estimates for 2014. Age and gender subgroup-specific mortality rates for each of the 43 modelled health conditions were taken from the most recent Centre for Public Health (CPH) report on Alcohol-Attributable Fractions (AAFs) in England (51). As SAPM3 requires mortality rates to be further stratified by socioeconomic status, which is not reported in the AAF report or in the general ONS mortality register data, the population figures are apportioned using evidence on socioeconomic gradients taken from Siegler et al. (52). Full details of the methodology underpinning this apportionment can be found in the technical appendix to Holmes et al. (9). An overview of the resulting baseline alcohol-related mortality rates is presented in

Table 3.8 and illustrated in Figure 3.10.

3.6.5 Morbidity model parameters

Morbidity prevalence rates are based on person-specific hospitalisations from the Hospital Episodes Statistics (HES) database, as calculated by the CPH report (51). When deriving morbidity rates from hospital admissions data, there are a number of ways in which individual admissions can be attributed to alcohol. In 2013, Public Health England announced a new 'narrow' measure of alcohol-related hospital admissions would be introduced alongside the existing 'broad' measure (53). Generally speaking the broad measure is likely to provide the most accurate estimate of the total burden of alcohol on the NHS, however it is sensitive to regional variations and changes over time in the coding practices used to ascribe diagnoses to individual admissions. The narrow measure is less sensitive to these differences and may therefore be more appropriate for tracking changes in admission rates over time, although it is likely to underestimate the total burden on the NHS. For more details on the two measures please see Perkins and Hennessey 2014 (54).

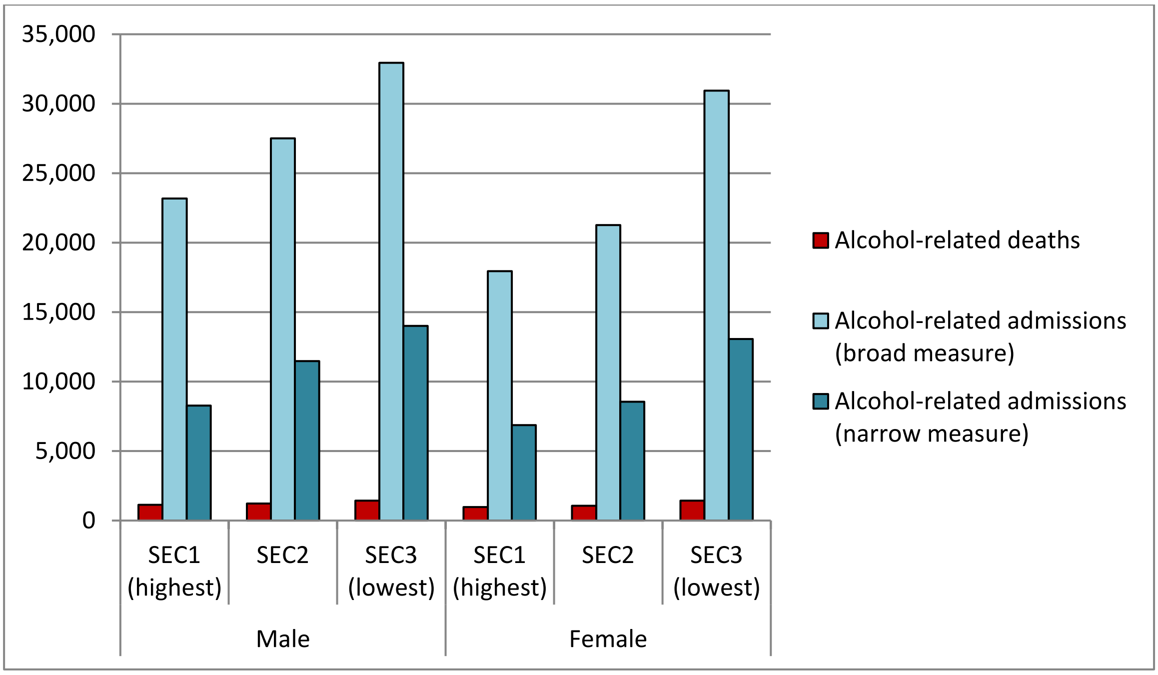
In order to examine the impact of using one measure over the other in policy appraisals, the results of the MUP modelling is presented using both broad and narrow measures. All results for IBA policies are presented using the broad measure only, in order to ensure comparability with previous IBA modelling.

The overall morbidity figures, using each measure, taken from the CPH report are apportioned between socioeconomic groups using the same methodology as for mortality described in Section 3.6.4. An overview of the resulting baseline alcohol-related morbidity rates used in the modelling is presented in Table 3.8 and illustrated in Figure 3.10. These highlight that lower socioeconomic groups suffer higher rates of alcohol-attributable harm using both broad and narrow measures. This finding has been observed across many studies in numerous countries (52,55,56) in spite of the fact that, as illustrated in Figure 3.1, lower socioeconomic groups are more likely to abstain from drinking. This apparently contradictory finding has been termed the 'Alcohol Harm Paradox' and numerous studies have attempted to explain it (57–59). Leading hypotheses include the fact that lower socioeconomic groups may drink in more harmful patterns, that there may be a higher concentration of other lifestyle risk factors (e.g. smoking, obesity) in these groups, that different socioeconomic groups have different trends in drinking across the life course, or that different groups may underreport their true levels of drinking to different extents (57).

Table 3.8 - Baseline alcohol-related mortality and morbidity rates per year per 100,000 population

		Alcohol-related deaths per 100,000 population	Alcohol-related hospital admissions per 100,000 population	
			Broad measure	Narrow measure
Male	SEC1 (highest)	1,145	23,177	8,278
	SEC2	1,217	27,505	11,473
	SEC3 (lowest)	1,430	32,942	14,000
Female	SEC1 (highest)	977	17,949	6,875
	SEC2	1,071	21,275	8,560
	SEC3 (lowest)	1,442	30,941	13,063

Figure 3.10 – Socioeconomic differences in baseline alcohol-related mortality and morbidity rates used in the model



3.6.6 Healthcare costs

Annual healthcare costs to the NHS associated with alcohol related harms are estimated based on estimates of the total NHS resource usage per hospital admission, including primary care visits, Accident and Emergency attendances and ambulance costs (4), inflated to 2014 prices using a healthcare-specific inflation index (60). Since the model works on person-specific morbidity, a multiplier was used to derive the number of actual hospital admissions. Separate multipliers were calculated for each health condition by analysts at the PHE KIT, from analysis of the mean number of admissions per year for a person admitted at least once with that condition as recorded in the HES data for England for the year 2012/13 using both measures. These multipliers are presented in Table 3.9.

Table 3.9 - Multipliers relating morbidity to annual hospital admissions

Condition	Narrow measure multiplier	Broad measure multiplier
Alcohol-induced pseudo-Cushing's syndrome	1.00	1.00
Degeneration	1.04	1.23
Alcoholic polyneuropathy	1.04	1.29
Alcoholic myopathy	1.00	1.16
Alcoholic cardiomyopathy	1.12	1.41
Alcoholic gastritis	1.08	1.12
Alcoholic liver disease	1.62	2.11
Acute pancreatitis (alcohol induced)	1.21	1.23
Chronic pancreatitis (alcohol induced)	1.39	1.74
Maternal care for (suspected) damage to foetus from alcohol	1.34	1.47
Mental and behavioural disorders due to use of alcohol	1.32	1.50
Excessive Blood Level of Alcohol	1.00	1.03
Toxic effect of alcohol	1.02	1.07
Accidental poisoning by exposure to alcohol	1.02	1.02
Intentional self-poisoning by and exposure to alcohol	1.16	1.18
Poisoning by and exposure to alcohol, undetermined intent	1.03	1.05
Evidence of alcohol involvement determined by blood alcohol level	1.02	1.03
Tuberculosis	1.37	1.49
Malignant neoplasm of lip, oral cavity and pharynx	2.57	2.81
Malignant neoplasm of oesophagus	2.80	3.22
Malignant neoplasm of colon and rectum	3.36	3.63
Malignant neoplasm of liver and intrahepatic bile ducts	2.29	2.60
Malignant neoplasm of larynx	2.01	2.24
Malignant neoplasm of breast	3.50	3.46
Diabetes mellitus (type II)	1.15	1.40
Epilepsy and status epilepticus	1.42	1.73
Hypertensive diseases	1.12	1.57
Ischaemic heart disease	1.33	1.42
Cardiac arrhythmias	1.25	1.57
Haemorrhagic and other non-ischaemic stroke	1.27	1.29
Ischaemic stroke	1.15	1.20
Lower respiratory infections: pneumonia	1.12	1.11
Cirrhosis of the liver	1.33	1.79
Acute and chronic pancreatitis	1.25	1.35
Transport injuries (including road traffic accidents)	1.02	1.02
Fall injuries	1.08	1.06
Exposure to mechanical forces (including machinery accidents)	1.15	1.12
Drowning	1.04	1.04
Other Unintentional Injuries	1.15	1.12
Accidental Poisoning by Exposure to Noxious Substances	1.02	1.02
Intentional self-harm	1.19	1.17
Assault	1.04	1.03
Other Intentional Injuries	1.15	1.02

3.6.7 Health-related quality of life

Health state utilities for all 43 conditions included in the model were derived from a single source, the Health Outcomes Data Repository (HODaR)(61), to avoid potential bias and variability between studies. The HODaR data measures utilities using the EQ-5D, a widely used generic (disease non-specific) quality of life instrument as recommended by NICE for health economic evaluation.

3.6.8 Valuation of Health Harms and Discounting

For the purpose of valuing total harm reduction, it was necessary to assign a financial value for discounted QALYs. Analyses were conducted assuming a financial value of £60,000 per QALY, consistent with Department of Health impact assessments. In line with NICE guidelines (3) for economic evaluations QALYs and costs were discounted at 3.5% annually. The perspective of analysis for MUP policies is societal, while for IBA policies we take an NHS perspective.

3.7 Crime and workplace outcomes

In addition to the health outcomes described in Section 3.6, for MUP policies we have also modelled the impact on alcohol-attributable crime volumes and alcohol-attributable absence from the workplace. These outcomes are modelled using the same PIF methodology as described in Sections 3.5.3 and 3.5.4, combined with a range of data sources outlined in Table 3.10. For full details of the modelling approach please see Purshouse et al. (4).

Table 3.10 - Summary of data sources for crime and workplace models

Data	Source
Baseline recorded crime	Police recorded crime data (62)
Relationship between recorded and actual crime volumes	Home Office estimates (63)
Crime Alcohol Attributable Fractions	Derived from Offending Crime and Justice Survey (OCJS) 2005 (64)
Crime risk functions	Calibrated using methodology described in Purshouse et al. (4)
Crime costs	Home Office estimates (63)
Baseline employment and workplace absence	Labour Force Survey (LFS) (65)
Absence Alcohol Attributable Fractions	Taken from Roche et al. (66)
Absence risk functions	Calibrated using methodology described in Purshouse et al. (4)
Costs of workplace absence	Based on salary data from the LFS inflated to 2014 prices (65)[4]

[4] Note that each day of absence is allocated a cost based on the mean pro-rata salary for an individual in that age-sex-socioeconomic group in the LFS. This may overestimate the true cost if the shortfall in work is covered by colleagues working more intensively, or retrospectively when the absentee returns to work. At the same time, this may be an overestimate if, as is argued by some economists, the correct valuation of the time lost is the employer's gross costs (i.e. including the employer's overheads).

4 RESULTS

4.1 MUP Policy results

This section contains model results for 5 different pricing policies: a 45p, 50p, 55p and 60p MUP and, for comparative purposes, a 10% increase in the price of all alcoholic drinks. Where appropriate health outcomes are presented using both the broad and narrow measures of hospital admissions (see Section 3.6.5 for details).

4.1.1 Impacts on alcohol consumption

Baseline characteristics and modelled policy impacts on alcohol consumption for the overall adult population and by a range of population subgroups are shown in Table 4.1 and, further broken down by both drinker and socioeconomic group, in Table 4.2. Absolute and relative changes in consumption across the 4 modelled MUP thresholds are illustrated by drinker group in Figure 4.1 and Figure 4.2, and by socioeconomic group in Figure 4.3 and Figure 4.4.

Table 4.1 - Estimated effects of pricing policies on alcohol consumption

	Population	Male	Female	Moderate	Increasing risk	High risk	SEC1 (highest)	SEC2	SEC3 (lowest)
Population ('000s)	42,926	21,179	21,747	33,872	7,038	2,016	15,356	10,528	16,503
Abstainers (%)	15.5%	12.5%	18.4%	19.6%	0.0%	0.0%	8.3%	15.7%	20.9%
Drinkers population ('000s)	36,278	18,528	17,749	27,224	7,038	2,016	14,085	8,875	13,051
Baseline units per week (per person)	11.5	14.7	8.4	4.4	26.8	76.7	12.8	11.9	10.2
Baseline units per week (per drinker)	13.6	16.8	10.3	5.5	26.8	76.7	13.9	14.2	12.9
Change in consumption per drinker (%)									
General price +10%	-4.5%	-5.7%	-2.5%	-4.5%	-4.5%	-4.6%	-3.6%	-4.6%	-5.5%
45p MUP	-1.1%	-1.6%	-0.3%	-0.6%	-0.7%	-2.2%	0.1%	-1.0%	-2.6%
50p MUP	-1.8%	-2.4%	-0.7%	-0.9%	-1.2%	-3.3%	0.0%	-1.7%	-3.8%
55p MUP	-2.7%	-3.5%	-1.3%	-1.4%	-1.9%	-4.8%	-0.2%	-2.6%	-5.4%
60p MUP	-3.9%	-4.8%	-2.3%	-2.3%	-3.0%	-6.4%	-0.7%	-3.9%	-7.3%
Change in consumption per drinker (units per year)									
General price +10%	-32.2	-50.2	-13.3	-12.9	-63.2	-184.6	-26.4	-33.7	-37.1
45p MUP	-8.0	-14.1	-1.6	-1.6	-9.5	-88.7	0.9	-7.6	-17.2
50p MUP	-12.6	-21.1	-3.7	-2.6	-16.3	-133.6	0.3	-12.4	-25.7
55p MUP	-18.9	-30.3	-6.9	-4.2	-26.4	-191.3	-1.3	-19.3	-36.4
60p MUP	-27.4	-41.9	-12.3	-6.5	-42.2	-257.6	-5.3	-29.0	-48.8

Table 4.2 - Estimated impact of pricing policies on alcohol consumption by drinker and socioeconomic group

	SEC1 (highest)			SEC2			SEC3 (lowest)		
	Moderate	**Increasing risk**	**High risk**	**Moderate**	**Increasing risk**	**High risk**	**Moderate**	**Increasing risk**	**High risk**
Population ('000s)	11,644	3,008	704	8,142	1,850	537	13,619	2,123	761
Abstainers (%)	10.9%	0.0%	0.0%	20.3%	0.0%	0.0%	25.3%	0.0%	0.0%
Drinkers population ('000s)	10,373	3,008	704	6,489	1,850	537	10,166	2,123	761
Baseline units per week (per person)	5.6	26.6	72.0	4.4	26.0	77.8	3.6	27.8	79.3
Baseline units per week (per drinker)	6.3	26.6	72.0	5.5	26.0	77.8	4.8	27.8	79.3
Change in consumption per drinker (%)									
General price +10%	-3.8%	-3.5%	-3.6%	-4.2%	-4.5%	-5.0%	-5.5%	-6.0%	-5.1%
45p MUP	-0.1%	0.3%	0.1%	-0.4%	-0.6%	-2.1%	-1.3%	-2.1%	-4.1%
50p MUP	-0.2%	0.3%	0.0%	-0.8%	-1.0%	-3.2%	-2.0%	-3.2%	-5.9%
55p MUP	-0.4%	0.1%	-0.4%	-1.3%	-1.8%	-4.7%	-2.9%	-4.7%	-8.1%
60p MUP	-0.9%	-0.4%	-1.1%	-2.1%	-3.0%	-6.6%	-4.2%	-6.6%	-10.3%
Change in consumption per drinker (units per year)									
General price +10%	-12.6	-48.6	-135.0	-12.1	-60.4	-201.5	-13.7	-86.6	-210.6
45p MUP	-0.3	4.2	4.5	-1.3	-7.6	-84.5	-3.2	-30.5	-167.6
50p MUP	-0.7	4.1	-1.2	-2.2	-14.0	-131.1	-4.9	-47.0	-243.3
55p MUP	-1.3	1.9	-15.1	-3.6	-24.0	-192.3	-7.3	-68.5	-334.5
60p MUP	-2.9	-5.4	-41.5	-6.0	-40.3	-267.1	-10.6	-95.9	-427.9

Figure 4.1 - Summary of relative consumption changes under modelled MUP policies by drinker group

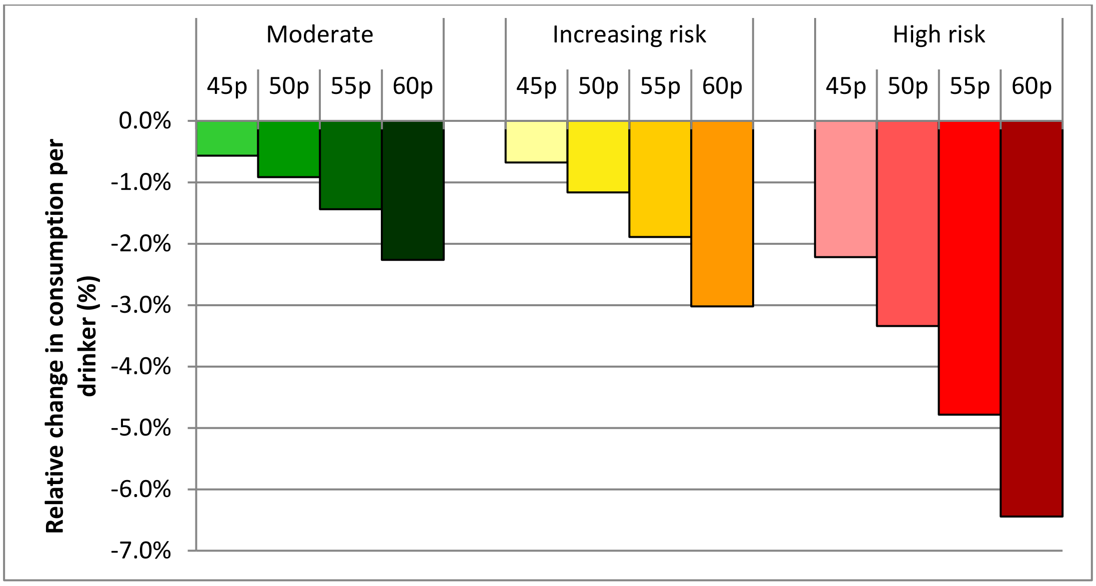


Figure 4.2 - Summary of absolute consumption changes under modelled MUP policies by drinker group

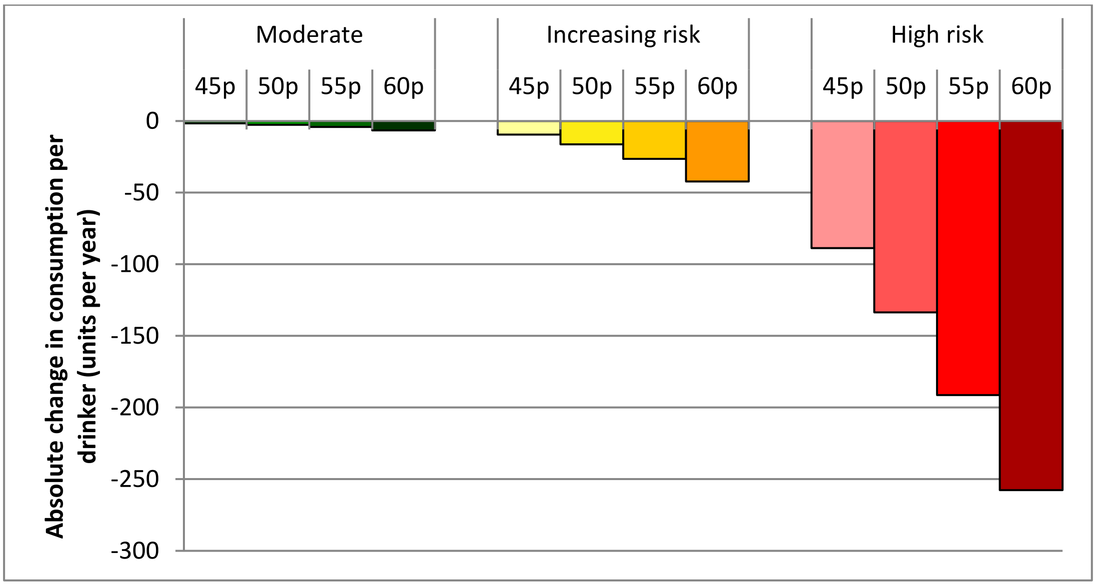


Figure 4.3 - Summary of relative consumption changes under modelled MUP policies by socioeconomic group

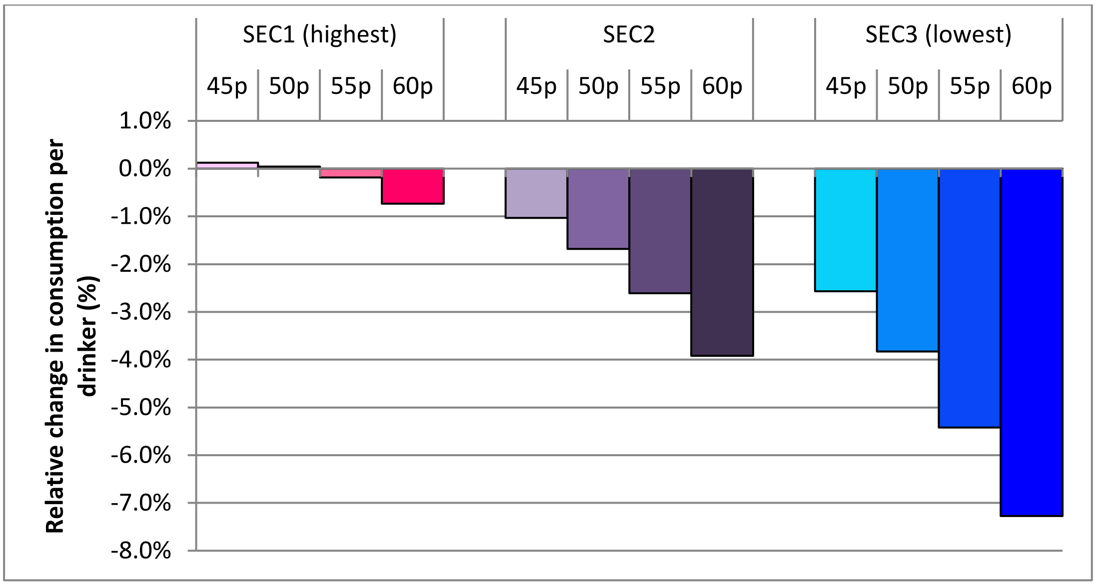
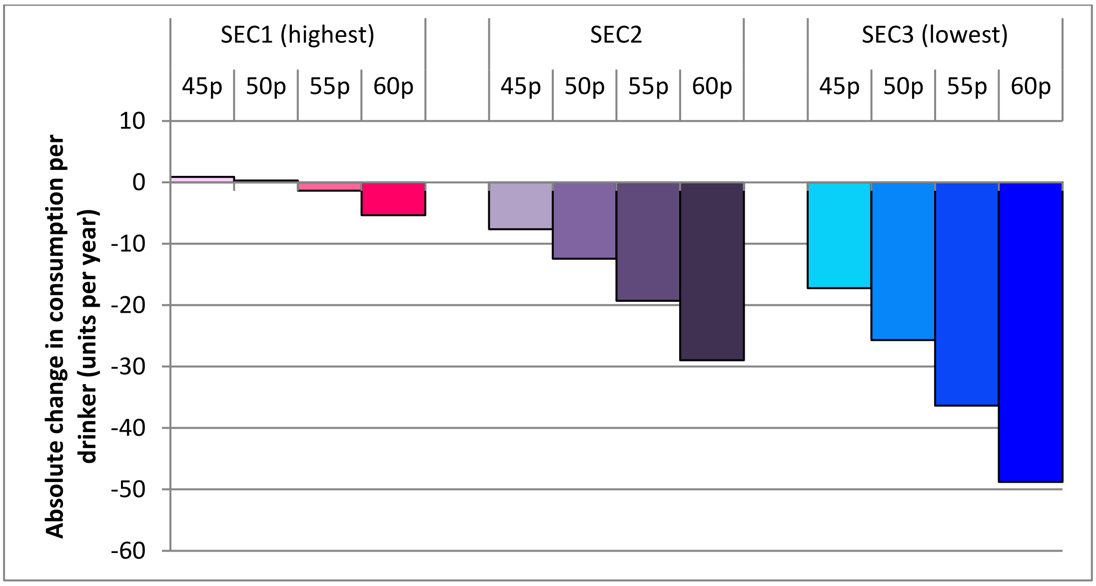


Figure 4.4 - Summary of absolute consumption changes under modelled MUP policies by socioeconomic group



4.1.2 Impacts on spending

Baseline characteristics and modelled policy impacts on spending on alcohol for the adult population and a range of population subgroups are shown in Table 4.3 and, further broken down by both drinker and socioeconomic group, in Table 4.4. Absolute and relative changes in spending across the four modelled MUP thresholds are illustrated by drinker group in Figure 4.5 and Figure 4.6, and by socioeconomic group in Figure 4.7 and Figure 4.8.

Table 4.3 - Estimated effects of pricing policies on annual spending on alcohol

	Population	Male	Female	Moderate	Increasing risk	High risk	SEC1 (highest)	SEC2	SEC3 (lowest)
Drinkers population ('000s)	36,278	18,528	17,749	27,224	7,038	2,016	14,085	8,875	13,051
Baseline annual spending (£ per drinker)	644	865	412	322	1231	2933	675	641	611
Change in spending per drinker (%)									
General price +10%	5.0%	3.6%	8.1%	5.5%	4.9%	4.4%	6.1%	4.9%	3.9%
45p MUP	0.8%	0.2%	2.0%	0.2%	0.9%	1.4%	1.2%	1.0%	0.1%
50p MUP	1.7%	0.7%	3.8%	0.7%	1.9%	2.8%	2.3%	2.1%	0.6%
55p MUP	2.8%	1.4%	6.1%	1.5%	3.3%	4.3%	3.9%	3.5%	1.3%
60p MUP	4.2%	2.0%	8.9%	2.3%	4.8%	6.1%	5.7%	5.0%	1.9%
Change in spending per drinker (£ per year)									
General price +10%	32.4	31.2	33.6	17.9	60.9	128.4	41.0	31.1	24.1
45p MUP	4.9	1.7	8.3	0.7	10.6	41.6	8.2	6.7	0.4
50p MUP	10.8	6.2	15.7	2.4	23.2	81.3	15.8	13.6	3.9
55p MUP	18.3	11.7	25.2	4.7	40.1	126.4	26.1	22.2	7.8
60p MUP	26.8	17.5	36.6	7.3	59.3	177.7	38.3	31.9	11.8

Table 4.4 - Estimated impact of modelled pricing policies on annual spending on alcohol by drinker and socioeconomic group

	SEC1 (highest)			SEC2			SEC3 (lowest)		
	Moderate	**Increasing risk**	**High risk**	**Moderate**	**Increasing risk**	**High risk**	**Moderate**	**Increasing risk**	**High risk**
Drinkers population ('000s)	10,373	3,008	704	6,489	1,850	537	10,166	2,123	761
Baseline annual spending (£ per drinker)	374	1205	2838	309	1134	2946	280	1352	2970
Change in spending per drinker (%)									
General price +10%	6.2%	6.1%	5.7%	5.8%	4.8%	3.8%	4.4%	3.6%	3.7%
45p MUP	0.5%	1.3%	2.3%	0.4%	1.1%	1.9%	-0.3%	0.1%	0.4%
50p MUP	1.1%	2.6%	4.3%	1.0%	2.2%	3.4%	0.0%	0.7%	1.3%
55p MUP	2.0%	4.3%	6.7%	1.9%	3.8%	5.1%	0.4%	1.5%	2.0%
60p MUP	3.0%	6.4%	9.4%	2.9%	5.6%	6.9%	0.8%	2.2%	3.0%
Change in spending per drinker (£ per year)									
General price +10%	23.4	73.2	162.9	17.8	54.4	112.3	12.5	48.8	110.7
45p MUP	1.9	16.1	66.6	1.2	12.1	54.6	-0.8	1.6	13.2
50p MUP	4.2	31.1	121.6	3.2	25.4	98.9	0.1	10.1	37.2
55p MUP	7.5	52.1	189.0	5.8	43.0	148.8	1.2	20.5	60.9
60p MUP	11.4	77.7	266.6	8.8	63.1	202.8	2.2	30.0	88.3

Figure 4.5 - Summary of relative spending changes under modelled MUP policies by drinker group

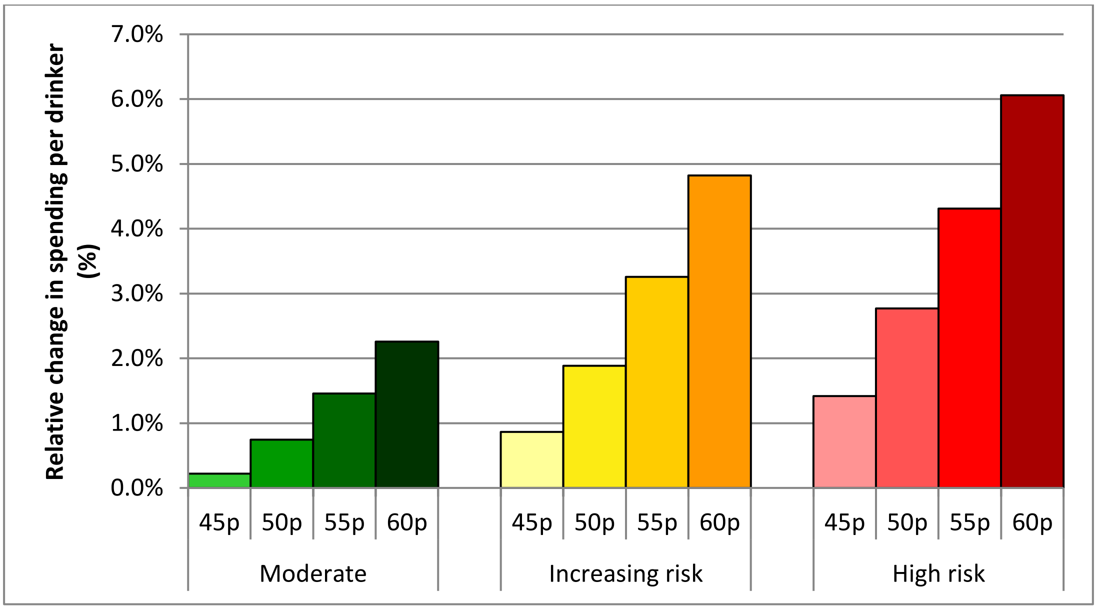


Figure 4.6 - Summary of absolute spending changes under modelled MUP policies by drinker group

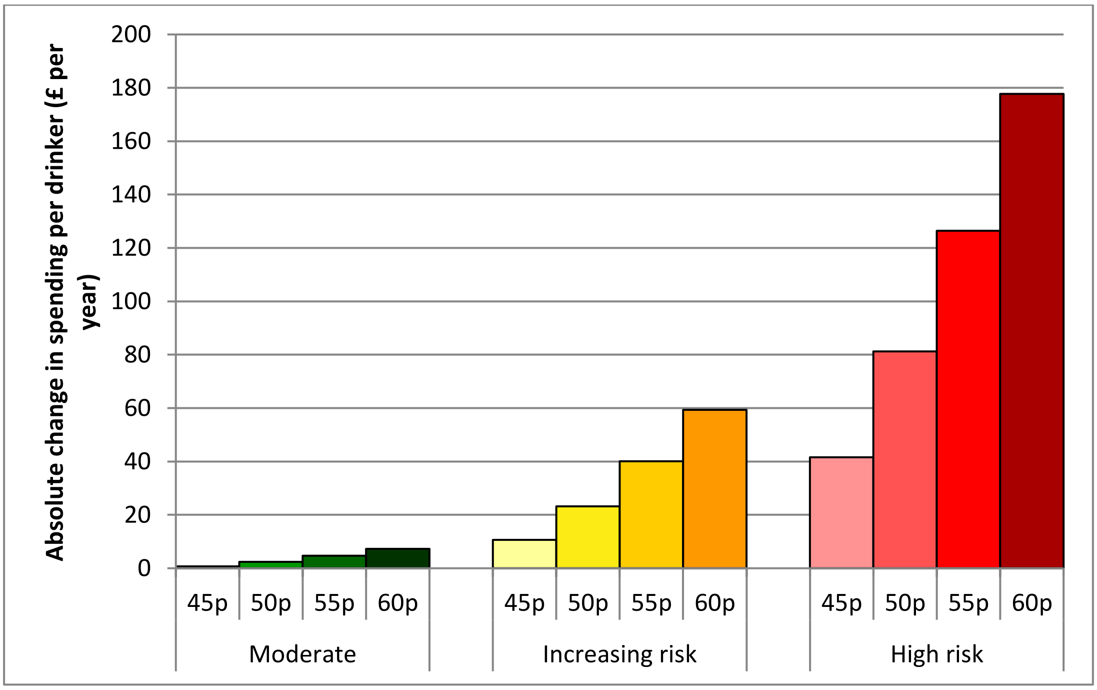


Figure 4.7 - Summary of relative spending changes under modelled MUP policies by socioeconomic group

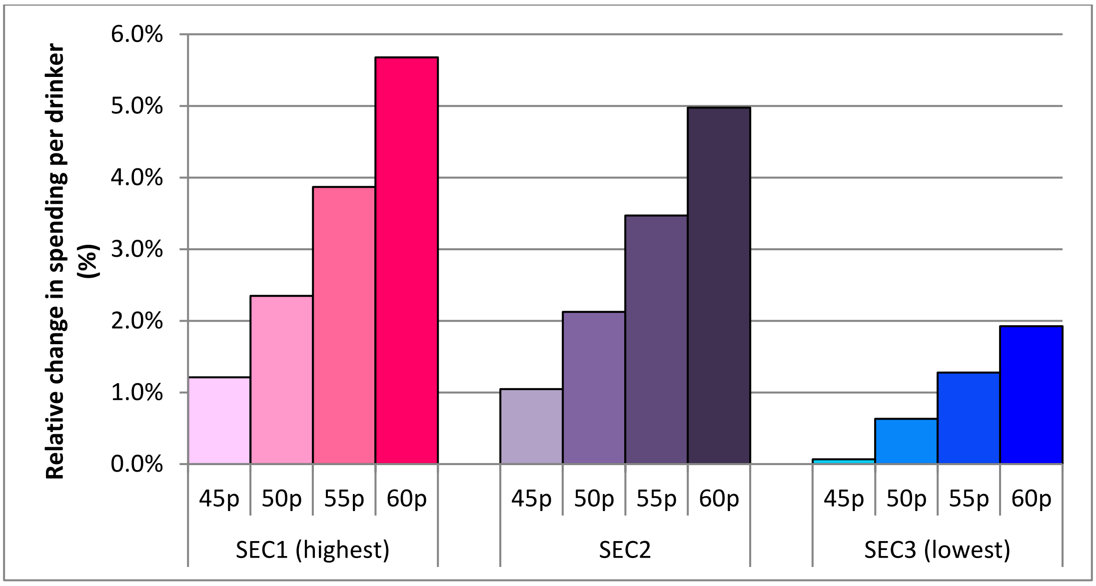
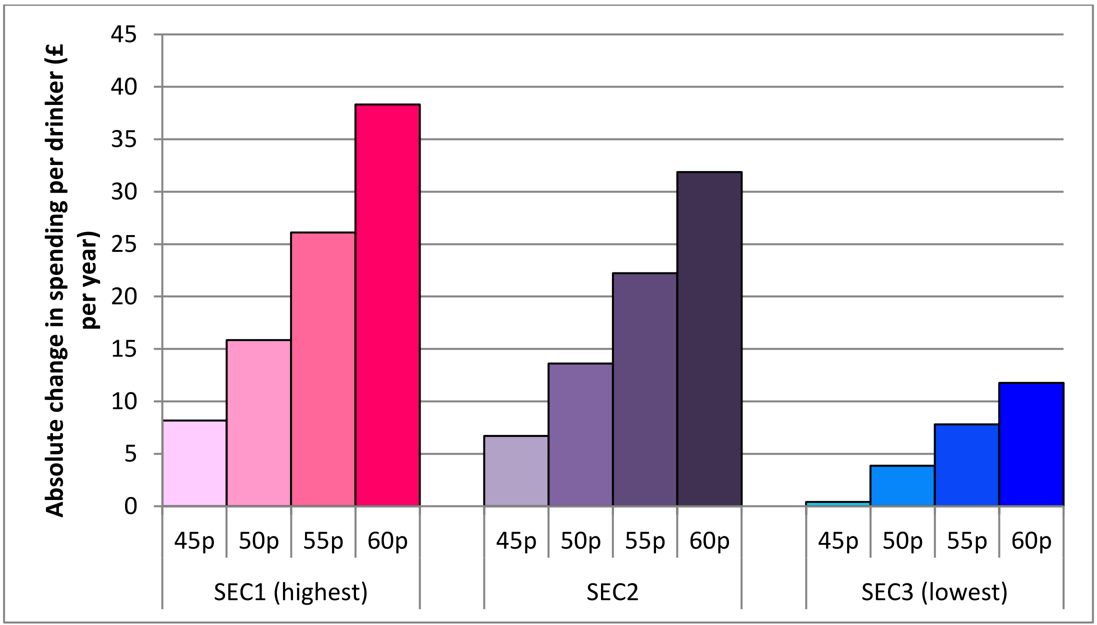


Figure 4.8 - Summary of absolute spending changes under modelled MUP policies by socioeconomic group



4.1.3 Impacts on health outcomes

The estimated impact of each modelled policy on deaths and hospital admissions using the broad and narrow measures are shown in Table 4.5, Table 4.6 and Table 4.7 respectively. The impact of the range of MUP thresholds on deaths, broken down by drinker group is illustrated in Figure 4.9 and broken down by socioeconomic group in Figure 4.10. Policy impacts are further broken down by drinker group in Table 4.8 and by socioeconomic group in Table 4.9. Using a 50p MUP as an exemplar policy, the relative impact on overall deaths and hospital admissions is illustrated in Figure 4.11. The combined breakdown by drinker and socioeconomic group is illustrated similarly in Figure 4.12.

As discussed in Section 3.6.3, the full effect of any policy which changes alcohol consumption will not be felt until 20 years after implementation. At the request of PHE health results are also presented for the 10^{th} year. Figure 4.13 illustrates the impact that this has on model outcomes, again using a 50p MUP as an example. This shows that under either the broad or the narrow measure, over 90% of the reduction in hospital admissions is experienced by the 10^{th} year, however less than two thirds of the full effect reduction in deaths has occurred. This is in large part due to alcohol-related cancers, which take at least 10 years before the impact of a change in consumption feeds through into a reduction in risk.

Table 4.5 - Summary of impacts of modelled policies on annual alcohol-attributable deaths by cause

		100% alcohol-attributable		Partially alcohol-attributable			
		Chronic conditions	**Acute conditions**	**Chronic conditions (excl. overall protective)**	**Acute conditions**	**Overall protective conditions[5]**	**Total deaths**
Baseline alcohol-attributable deaths (p.a.)		4,521	848	11,879	3,284	-8,342	12,190
10th year following policy implementation	**Relative change (%)**						
	General price +10%	-7.2%	-6.7%	-2.2%	-6.4%	1.1%	-7.7%
	45p MUP	-2.3%	-1.1%	-0.4%	-1.4%	0.0%	-1.8%
	50p MUP	-3.6%	-1.8%	-0.7%	-2.4%	0.2%	-2.9%
	55p MUP	-5.3%	-2.9%	-1.1%	-3.7%	0.4%	-4.5%
	60p MUP	-7.4%	-4.4%	-1.7%	-5.4%	0.7%	-6.6%
	Absolute change (p.a.)						
	General price +10%	-326	-57	-262	-209	-91	-944
	45p MUP	-106	-9	-50	-48	-3	-216
	50p MUP	-164	-16	-85	-78	-13	-356
	55p MUP	-241	-25	-133	-120	-32	-550
	60p MUP	-337	-37	-197	-177	-62	-810
20th year following policy implementation (full effect)	**Relative change (%)**						
	General price +10%	-9.1%	-6.9%	-4.7%	-6.2%	0.7%	-10.6%
	45p MUP	-3.2%	-1.2%	-1.1%	-1.4%	-0.1%	-2.7%
	50p MUP	-5.0%	-2.0%	-1.8%	-2.4%	-0.1%	-4.3%
	55p MUP	-7.2%	-3.1%	-2.8%	-3.6%	0.1%	-6.6%
	60p MUP	-10.0%	-4.7%	-4.0%	-5.4%	0.3%	-9.6%
	Absolute change (p.a.)						
	General price +10%	-410	-58	-561	-204	-59	-1,292
	45p MUP	-145	-10	-134	-47	9	-328
	50p MUP	-224	-17	-217	-78	6	-530
	55p MUP	-327	-26	-327	-120	-5	-804
	60p MUP	-452	-40	-472	-177	-26	-1,166

[5] Three health conditions included in the model; ischaemic heart disease, ischaemic stroke and type II diabetes, are estimated to have an overall protective effect from alcohol. The existence of this protective effect is the subject of considerable debate in the scientific literature (e.g. Fekjaer et al. (75))

Table 4.6 - Summary of impacts of modelled policies on annual alcohol-attributable hospital admissions by cause (broad measure)

		100% alcohol-attributable		Partially alcohol-attributable			
		Chronic conditions	**Acute conditions**	**Chronic conditions (excl. overall protective)**	**Acute conditions**	**Overall protective conditions**	**Total hospital admissions**
Baseline alcohol-attributable hospital admissions (broad measure) (p.a.)		59,506	238,522	520,439	205,204	-183,633	840,037
10th year following policy implementation	**Relative change (%)**						
	General price +10%	-7.7%	-6.4%	-5.3%	-5.5%	0.0%	-7.0%
	45p MUP	-2.6%	-1.3%	-1.1%	-1.2%	0.1%	-1.5%
	50p MUP	-4.0%	-2.0%	-1.8%	-2.0%	0.1%	-2.5%
	55p MUP	-5.9%	-3.1%	-2.8%	-3.1%	0.1%	-3.8%
	60p MUP	-8.1%	-4.6%	-4.1%	-4.7%	0.1%	-5.6%
	Absolute change (p.a.)						
	General price +10%	-4,557	-15,216	-27,413	-11,382	-45	-58,614
	45p MUP	-1,563	-2,982	-5,712	-2,478	-135	-12,871
	50p MUP	-2,396	-4,832	-9,390	-4,128	-188	-20,934
	55p MUP	-3,485	-7,426	-14,466	-6,456	-183	-32,017
	60p MUP	-4,818	-11,075	-21,570	-9,714	-253	-47,430
20th year following policy implementation (full effect)	**Relative change (%)**						
	General price +10%	-9.4%	-6.5%	-5.6%	-5.4%	-0.1%	-7.3%
	45p MUP	-3.5%	-1.3%	-1.2%	-1.2%	0.0%	-1.7%
	50p MUP	-5.3%	-2.2%	-2.0%	-2.0%	0.0%	-2.7%
	55p MUP	-7.7%	-3.3%	-3.0%	-3.1%	0.0%	-4.1%
	60p MUP	-10.5%	-4.9%	-4.5%	-4.7%	0.0%	-6.1%
	Absolute change (p.a.)						
	General price +10%	-5,584	-15,456	-29,120	-11,115	236	-61,038
	45p MUP	-2,077	-3,173	-6,320	-2,462	-61	-14,092
	50p MUP	-3,169	-5,131	-10,321	-4,107	-68	-22,797
	55p MUP	-4,582	-7,857	-15,797	-6,421	1	-34,656
	60p MUP	-6,277	-11,640	-23,424	-9,651	3	-50,989

Table 4.7 - Summary of impacts of modelled policies on annual alcohol-attributable hospital admissions by cause (narrow measure)

		100% alcohol-attributable		Partially alcohol-attributable			
		Chronic conditions	**Acute conditions**	**Chronic conditions (excl. overall protective)**	**Acute conditions**	**Overall protective conditions**	**Total hospital admissions**
Baseline alcohol-attributable hospital admissions (narrow measure) (p.a.)		15,578	37,807	57,235	202,211	-50,664	262,166
10th year following policy implementation	**Relative change (%)**						
	General price +10%	-7.8%	-6.4%	-5.8%	-5.5%	0.0%	-6.9%
	45p MUP	-2.8%	-1.3%	-2.4%	-1.2%	0.2%	-1.9%
	50p MUP	-4.3%	-2.1%	-3.3%	-2.0%	0.3%	-2.9%
	55p MUP	-6.2%	-3.2%	-4.3%	-3.2%	0.2%	-4.3%
	60p MUP	-8.5%	-4.8%	-5.3%	-4.8%	0.3%	-6.1%
	Absolute change (p.a.)						
	General price +10%	-1,214	-2,425	-3,339	-11,215	-24	-18,216
	45p MUP	-434	-501	-1,372	-2,463	-92	-4,863
	50p MUP	-664	-805	-1,884	-4,102	-127	-7,581
	55p MUP	-963	-1,227	-2,446	-6,411	-126	-11,174
	60p MUP	-1,327	-1,815	-3,058	-9,638	-148	-15,987
20th year following policy implementation (full effect)	**Relative change (%)**						
	General price +10%	-9.3%	-6.5%	-7.1%	-5.4%	-0.1%	-7.2%
	45p MUP	-3.6%	-1.4%	-2.8%	-1.2%	0.1%	-2.0%
	50p MUP	-5.5%	-2.3%	-3.9%	-2.0%	0.2%	-3.1%
	55p MUP	-7.9%	-3.5%	-5.2%	-3.2%	0.1%	-4.6%
	60p MUP	-10.9%	-5.1%	-6.6%	-4.7%	0.2%	-6.5%
	Absolute change (p.a.)						
	General price +10%	-1,452	-2,471	-4,039	-10,957	63	-18,855
	45p MUP	-563	-538	-1,621	-2,451	-73	-5,246
	50p MUP	-858	-861	-2,254	-4,086	-95	-8,153
	55p MUP	-1,237	-1,309	-2,968	-6,384	-76	-11,973
	60p MUP	-1,691	-1,921	-3,767	-9,585	-76	-17,040

Table 4.8 - Consumption group-specific health outcomes - policy impacts on deaths and hospital admissions per year per 100,000 population

		Deaths			Hospital admission (broad measure)			Hospital admission (narrow measure)		
		Moderate	**Increasing risk**	**High risk**	**Moderate**	**Increasing risk**	**High risk**	**Moderate**	**Increasing risk**	**High risk**
Alcohol-attributable baseline (per 100,000 population)		-11[6]	71	500	278	4,753	21,324	135	1,495	5,962
Absolute change (per 100,000 population)										
10th year following policy implementation	General price +10%	0	-7	-22	-55	-322	-1,036	-17	-104	-307
	45p MUP	0	-1	-8	-8	-33	-421	-3	-16	-144
	50p MUP	0	-1	-13	-12	-66	-640	-5	-29	-211
	55p MUP	0	-2	-19	-19	-116	-921	-7	-47	-293
	60p MUP	0	-4	-26	-30	-197	-1,264	-11	-74	-389
20th year following policy implementation (full effect)	General price +10%	0	-9	-28	-58	-338	-1,068	-18	-109	-315
	45p MUP	0	-1	-12	-8	-36	-467	-3	-18	-158
	50p MUP	0	-2	-19	-13	-73	-706	-5	-31	-231
	55p MUP	0	-3	-27	-20	-127	-1,008	-7	-51	-319
	60p MUP	0	-5	-37	-31	-212	-1,373	-11	-79	-421

[6] The estimated baseline alcohol-attributable deaths for moderate drinkers is negative as a result of the protective effects discussed in the footnote to Table 4.5

Table 4.9 - Socioeconomic group-specific health outcomes - policy impacts on deaths and hospital admissions per year per 100,000 population

		Deaths			Hospital admission (broad measure)			Hospital admission (narrow measure)		
		SEC1 (highest)	**SEC2**	**SEC3 (lowest)**	**SEC1 (highest)**	**SEC2**	**SEC3 (lowest)**	**SEC1 (highest)**	**SEC2**	**SEC3 (lowest)**
Alcohol-attributable baseline (per 100,000 population)		12	38	309	889	2,564	20,709	226	788	7,206
Absolute change (per 100,000 population)										
10th year following policy implementation	General price +10%	-1	-3	-26	-49	-174	-1,632	-13	-53	-545
	45p MUP	0	0	-13	10	-9	-745	2	-5	-253
	50p MUP	0	0	-20	12	-22	-1,119	2	-9	-375
	55p MUP	0	-1	-28	11	-44	-1,585	2	-17	-522
	60p MUP	0	-2	-37	5	-83	-2,137	0	-29	-695
20th year following policy implementation (full effect)	General price +10%	-1	-4	-36	-46	-174	-1,803	-12	-52	-595
	45p MUP	0	0	-18	11	38	-699	2	-4	-279
	50p MUP	0	-1	-27	13	34	-1,131	3	-8	-413
	55p MUP	0	-1	-39	13	14	-1,719	2	-14	-577
	60p MUP	0	-2	-52	9	-42	-2,530	1	-26	-767

Figure 4.9 - Impact of modelled MUP policies on annual alcohol-related deaths by drinker group

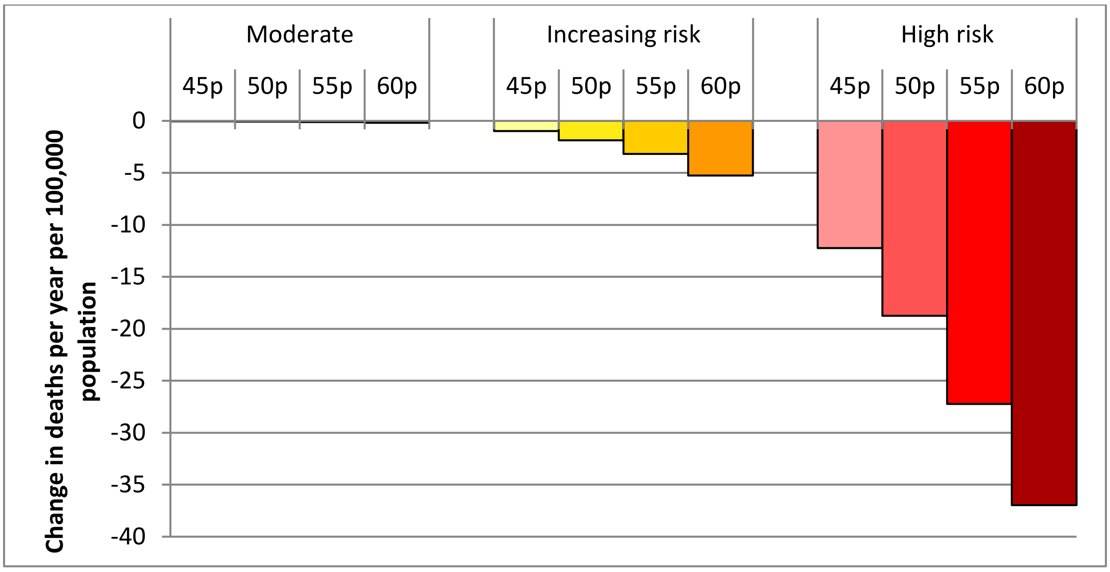


Figure 4.10 - Impact of modelled MUP policies on annual alcohol-related deaths by socioeconomic group

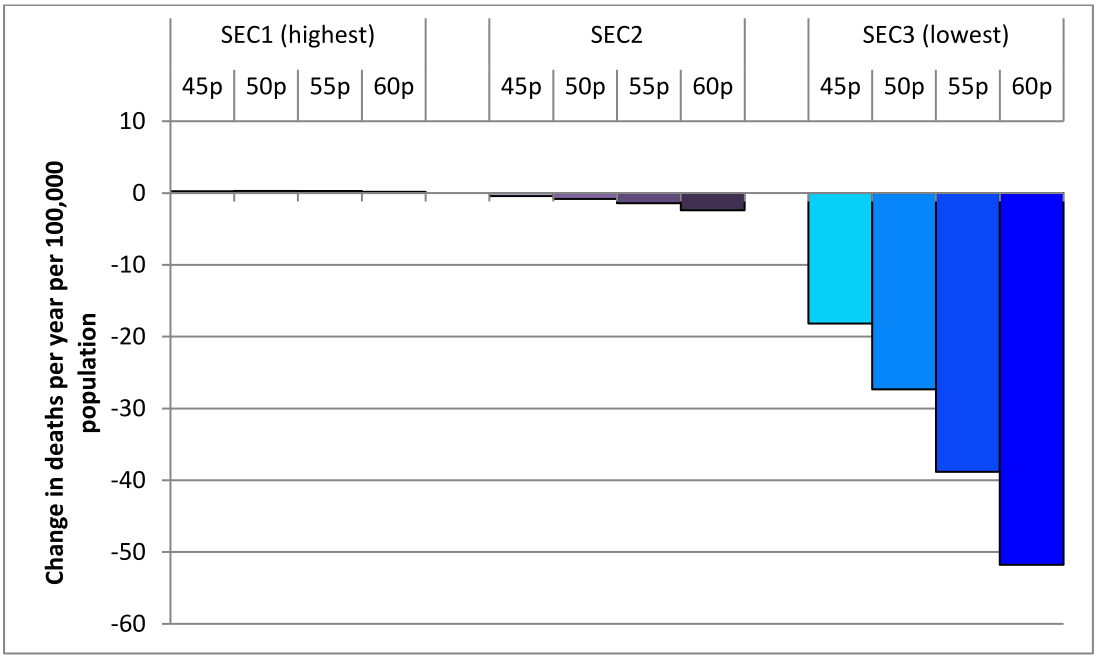


Figure 4.11 - Summary of relative changes in health outcomes under a 50p MUP at full effect (20 years)

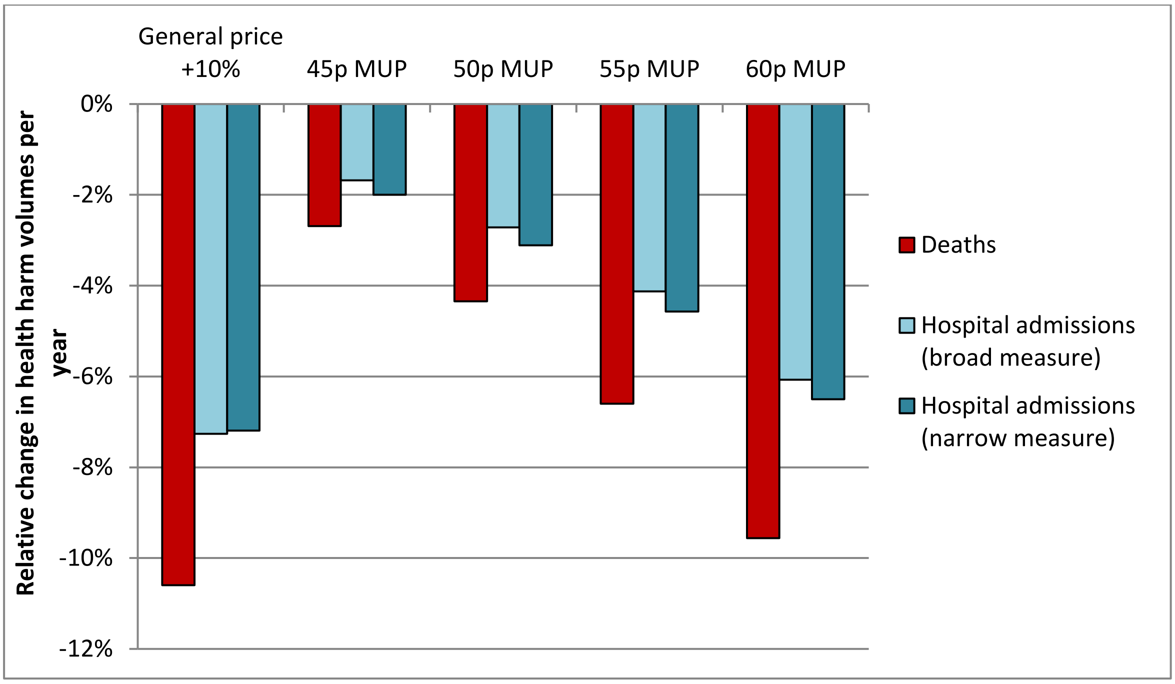


Figure 4.12 - Summary of changes in health outcomes by income and drinker group under a 50p MUP at full effect (20 years)

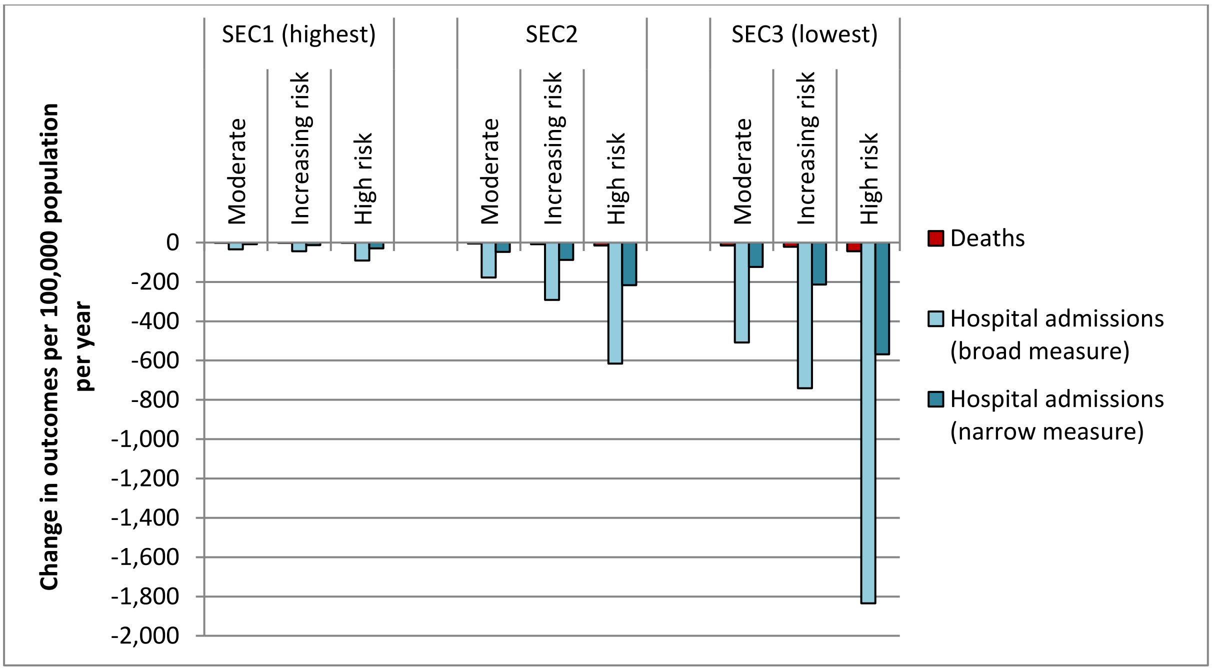
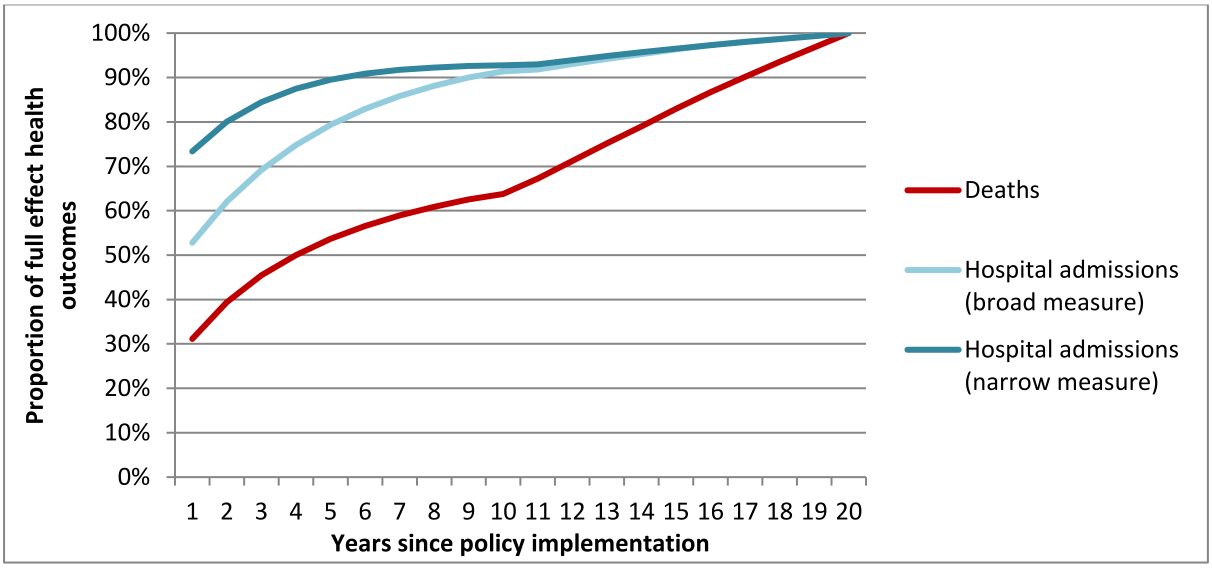


Figure 4.13 - Estimated distribution over time of health gains from a 50p MUP



4.1.4 Impacts on crime outcomes

The estimated impact of each modelled policy on annual crime volumes is shown in Table 4.10, including the differential impact by drinker group. These are illustrated in Figure 4.14, while Table 4.11 shows the breakdown of offences averted by crime category.

Table 4.10 - Impact of modelled policies on annual crime volumes

	Change in annual crime volumes			
	Population	**Moderate**	**Increasing risk**	**High risk**
Baseline annual alcohol-attributable crime	1,420,924	669,474	467,379	284,071
Relative change (%)				
General price +10%	-6.3%	-8.6%	-5.9%	-1.5%
45p MUP	-1.7%	-1.9%	-1.7%	-1.0%
50p MUP	-2.5%	-2.8%	-2.6%	-1.3%
55p MUP	-3.5%	-4.1%	-3.8%	-1.8%
60p MUP	-4.9%	-5.8%	-5.3%	-2.3%
Absolute change				
General price +10%	-89,168	-57,451	-27,513	-4,204
45p MUP	-23,615	-12,967	-7,911	-2,737
50p MUP	-34,951	-19,025	-12,111	-3,815
55p MUP	-50,214	-27,400	-17,671	-5,143
60p MUP	-70,163	-38,623	-24,877	-6,663

Figure 4.14 - Summary of relative changes in alcohol-attributable crime volumes under modelled MUP policies by drinker group

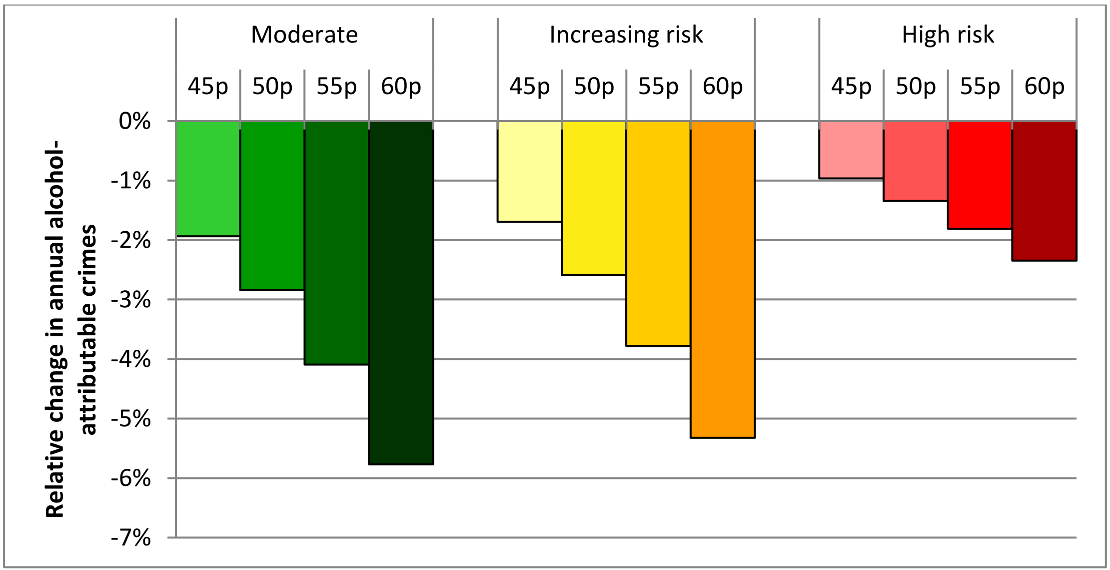


Table 4.11 - Estimated changes in annual crime volumes by crime category

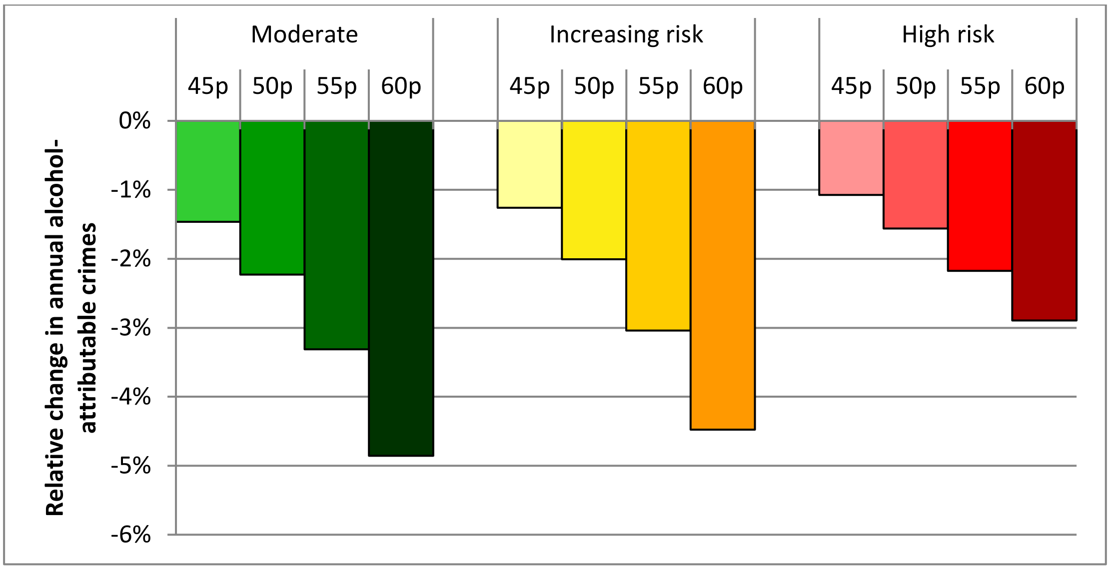
	Change in annual crime volumes		
	Violent crimes	Criminal damage	Robbery, burglary & theft
Baseline alcohol-attributable crime	363,274	902,891	154,759
Relative change (%)			
General price +10%	-6.5%	-6.2%	-6.1%
45p MUP	-1.7%	-1.7%	-1.6%
50p MUP	-2.5%	-2.5%	-2.4%
55p MUP	-3.6%	-3.5%	-3.4%
60p MUP	-5.0%	-4.9%	-4.9%
Absolute change			
General price +10%	-23,651	-56,082	-9,435
45p MUP	-6,018	-15,143	-2,455
50p MUP	-8,994	-22,281	-3,675
55p MUP	-13,011	-31,873	-5,330
60p MUP	-18,293	-44,350	-7,520

4.1.5 Impacts on workplace outcomes

Table 4.12 - Estimated impact of modelled policies on alcohol-related workplace absence

	Change in days absence from work (1,000s)			
	Population	Moderate	Increasing risk	High risk
Baseline alcohol-attributable absence	7,709	3,469	2,725	1,515
Relative change (%)				
General price +10%	-5.7%	-7.7%	-5.4%	-1.8%
45p MUP	-1.3%	-1.5%	-1.3%	-1.1%
50p MUP	-2.0%	-2.2%	-2.0%	-1.6%
55p MUP	-3.0%	-3.3%	-3.0%	-2.2%
60p MUP	-4.3%	-4.9%	-4.5%	-2.9%
Absolute change				
General price +10%	-442	-267	-148	-28
45p MUP	-101	-51	-34	-16
50p MUP	-156	-77	-55	-24
55p MUP	-231	-115	-83	-33
60p MUP	-334	-168	-122	-44

Figure 4.15 - Summary of relative changes in workplace absence for modelled MUP policies by drinker group



4.1.6 Impacts on societal costs

Table 4.13 gives an overview of the estimated savings resulting from the implementation of each of the modelled policies in the first year following implementation. Table 4.14 presents the cumulative valuation over 20 years, after discounting. Savings are presented separately for healthcare costs, costs of crime and the cost of workplace absenteeism, as illustrated in Figure 4.16. It should be noted that these costs may not be fully realised in practice as, for example, the crime costs incorporate a financial valuation of the impact on the victim's quality of life (63).

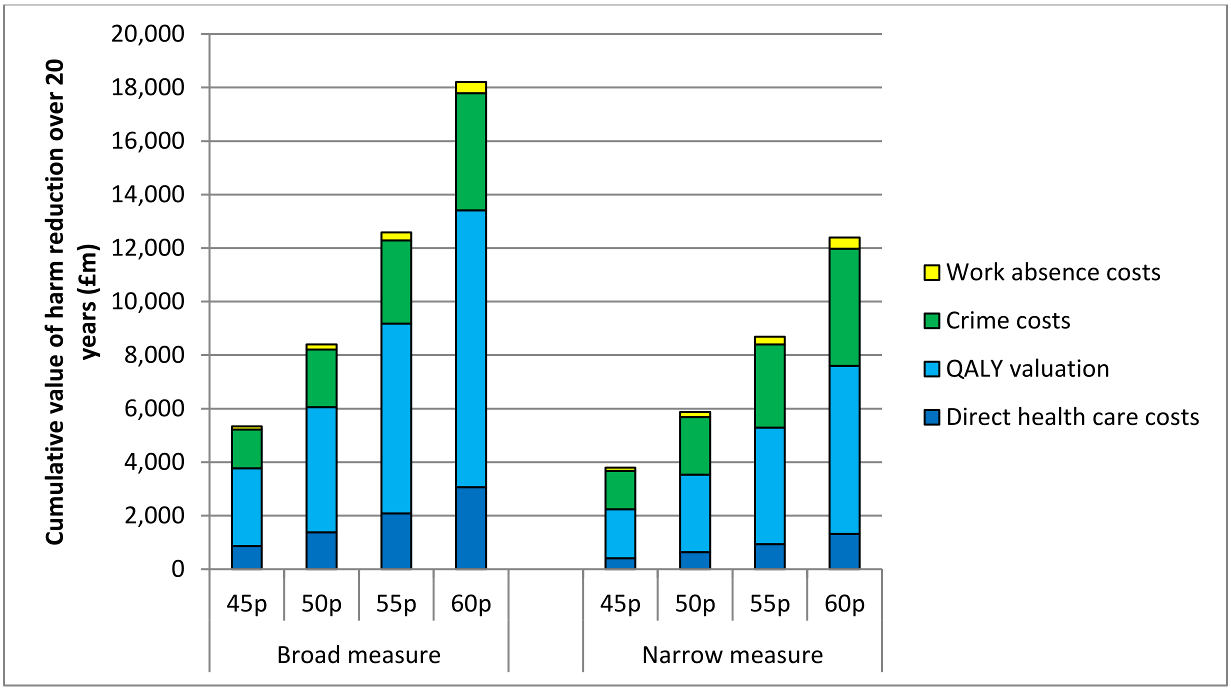
Table 4.13 - Summary of financial valuation of impact of modelled policies on health, crime and workplace related harm in 1st year following policy implementation

	Value of harm reductions in year 1 (£m)									
	Broad measure of hospitalisations					**Narrow measure of hospitalisations**				
	Direct health care costs	**QALY valuation**	**Crime costs**	**Work absence costs**	**Total costs**	**Direct health care costs**	**QALY valuation**	**Crime costs**	**Work absence costs**	**Total costs**
Alcohol-attributable cost (£m)	2,449	5,991	5,826	680	14,945	1,222	2,444	5,826	680	10,172
Relative change (%)										
General price +10%	-6.8%	-6.5%	-6.7%	-5.9%	-6.6%	-6.7%	-6.4%	-6.7%	-5.9%	-6.6%
45p MUP	-1.6%	-1.5%	-1.7%	-1.2%	-1.6%	-1.8%	-1.7%	-1.7%	-1.2%	-1.7%
50p MUP	-2.6%	-2.4%	-2.5%	-1.9%	-2.5%	-2.9%	-2.7%	-2.5%	-1.9%	-2.6%
55p MUP	-3.9%	-3.7%	-3.6%	-2.9%	-3.7%	-4.3%	-4.0%	-3.6%	-2.9%	-3.8%
60p MUP	-5.7%	-5.4%	-5.1%	-4.3%	-5.3%	-6.2%	-5.8%	-5.1%	-4.3%	-5.3%
Absolute change										
General price +10%	-167	-391	-392	-40	-990	-82	-156	-392	-40	-670
45p MUP	-39	-91	-98	-8	-236	-22	-42	-98	-8	-171
50p MUP	-63	-145	-146	-13	-367	-35	-66	-146	-13	-260
55p MUP	-95	-220	-211	-20	-546	-52	-99	-211	-20	-382
60p MUP	-139	-323	-297	-29	-788	-75	-142	-297	-29	-544

Table 4.14 - Summary of cumulative financial valuation of impact of modelled policies on health, crime and workplace related harm over 20 years following policy implementation

	Cumulative value of harm reductions over 20 years (£m, discounted)									
	Broad measure of hospitalisations					**Narrow measure of hospitalisations**				
	Direct health care costs	**QALY valuation**	**Crime costs**	**Work absence costs**	**Total costs**	**Direct health care costs**	**QALY valuation**	**Crime costs**	**Work absence costs**	**Total costs**
Alcohol-attributable cost (£m)	49,097	135,597	85,694	10,000	280,388	19,180	65,936	85,694	10,000	180,809
Relative change (%)										
General price +10%	-7.5%	-8.9%	-6.7%	-5.9%	-7.9%	-7.5%	-10.6%	-6.7%	-5.9%	-8.2%
45p MUP	-1.8%	-2.1%	-1.7%	-1.2%	-1.9%	-2.2%	-2.8%	-1.7%	-1.2%	-2.1%
50p MUP	-2.8%	-3.5%	-2.5%	-1.9%	-3.0%	-3.3%	-4.4%	-2.5%	-1.9%	-3.3%
55p MUP	-4.3%	-5.2%	-3.6%	-2.9%	-4.5%	-4.9%	-6.6%	-3.6%	-2.9%	-4.8%
60p MUP	-6.2%	-7.6%	-5.1%	-4.3%	-6.5%	-6.9%	-9.5%	-5.1%	-4.3%	-6.9%
Absolute change										
General price +10%	-3,659	-12,092	-5,770	-594	-22,115	-1,432	-6,970	-5,770	-594	-14,766
45p MUP	-860	-2,915	-1,439	-125	-5,338	-413	-1,824	-1,439	-125	-3,800
50p MUP	-1,380	-4,680	-2,150	-195	-8,404	-639	-2,899	-2,150	-195	-5,882
55p MUP	-2,090	-7,093	-3,110	-292	-12,584	-935	-4,354	-3,110	-292	-8,691
60p MUP	-3,061	-10,356	-4,369	-429	-18,215	-1,324	-6,278	-4,369	-429	-12,400

Figure 4.16 - Breakdown of cumulative value of harm reduction over 20 years by outcome



4.1.7 Detailed results for 50p MUP policy

Table 4.15 - Detailed consumption and spending results for a 50p MUP

	Population	Male	Female	SEC1 (highest)	SEC2	SEC3 (lowest)	Moderate	Increasing risk	High risk
Baseline statistics									
Baseline Consumption (units per week)	11.5	14.7	8.4	12.8	11.9	10.2	4.4	26.8	76.7
Population size (000,000s)	42.9	21.2	21.7	15.4	10.5	16.5	33.9	7.0	2.0
Baseline Consumption (drinker)	13.6	16.8	10.3	13.9	14.2	12.9	5.5	26.8	76.7
Drinker population (000,000s)	36.3	18.5	17.7	14.1	8.9	13.1	27.2	7.0	2.0
% drinkers	84.5%	87.5%	81.6%	91.7%	84.3 %	79.1%	80.4%	100.0%	100.0%
Sales/consumption volume, units per drinker per year									
Off-beer	84.8	120.5	47.5	62.7	91.0	103.7	28.1	161.3	582.7
Off-cider	15.7	21.1	10.2	9.3	16.8	21.4	4.3	22.5	146.7
Off-wine	289.9	257.0	324.3	357.4	328.3	194.2	90.3	599.3	1905.7
Off-spirits	65.2	67.3	63.0	59.1	60.8	73.8	24.8	141.0	345.6
Off-RTDs	2.6	1.2	4.1	1.4	1.1	4.8	1.4	3.9	14.9
On-beer	174.6	314.7	28.4	149.5	171.9	201.8	85.8	338.5	801.5
On-cider	6.7	10.8	2.3	5.2	6.5	8.4	3.4	11.9	32.4
On-wine	43.2	51.7	34.3	61.8	39.4	26.0	29.9	74.6	112.8
On-spirits	21.9	25.8	17.8	18.7	21.0	25.7	17.9	33.8	34.8
On-RTDs	5.2	5.3	5.1	1.9	2.2	10.7	2.7	10.0	21.2
Total	**709.8**	**875.3**	**536.9**	**727.0**	**739.0**	**670.6**	**288.6**	**1396.9**	**3998.1**
Spending, £ per drinker per year									
Off-beer	40.7	58.3	22.3	31.4	43.0	48.8	14.9	77.8	259.3
Off-cider	6.5	8.5	4.4	4.2	6.9	8.4	2.1	9.8	53.4
Off-wine	175.4	160.6	190.9	229.5	193.9	106.5	57.8	366.8	1096.1
Off-spirits	36.1	37.6	34.6	34.0	33.7	39.7	14.6	78.6	178.2
Off-RTDs	2.7	1.2	4.3	1.5	1.2	5.0	1.5	4.1	14.3
On-beer	236.2	425.0	39.1	209.0	230.6	267.9	122.4	451.9	1019.6
On-cider	8.8	14.5	2.9	7.1	8.6	10.8	4.7	15.6	41.0
On-wine	65.4	78.1	52.2	99.0	59.5	33.9	47.2	114.4	140.7
On-spirits	61.2	70.8	51.1	55.2	58.5	68.8	51.2	91.1	91.0
On-RTDs	10.6	11.0	10.1	4.1	4.6	21.5	5.8	20.7	39.9
Total	**643.6**	**865.5**	**411.9**	**674.9**	**640.6**	**611.2**	**322.2**	**1230.9**	**2933.4**
After intervention / change from baseline									
Changes in consumption (units per drinker)	-0.2	-0.4	-0.1	0.0	-0.2	-0.5	-0.1	-0.3	-2.6
Changes in consumption (%)	-1.8%	-2.4%	-0.7%	0.0%	-1.7%	-3.8%	-0.9%	-1.2%	-3.3%
Final Consumption (drinker)	13.4	16.4	10.2	13.9	13.9	12.4	5.5	26.5	74.1
Absolute change in sales/consumption volume, units per drinker per year									
Off-beer	-10.2	-13.5	-6.7	-6.1	-12.0	-13.2	-1.8	-17.7	-97.0
Off-cider	-7.4	-10.6	-4.1	-3.4	-7.7	-11.1	-1.2	-9.1	-85.8
Off-wine	11.5	11.1	11.8	13.8	13.3	7.8	2.0	23.1	99.1
Off-spirits	-4.8	-4.9	-4.7	-4.0	-4.5	-5.8	-1.1	-10.4	-35.3
Off-RTDs	-0.6	-0.2	-0.9	-0.2	-0.2	-1.2	-0.2	-0.8	-4.7
On-beer	-3.0	-5.5	-0.5	-2.2	-3.0	-3.9	-1.1	-5.4	-20.8
On-cider	0.3	0.4	0.1	0.2	0.3	0.4	0.1	0.5	1.7
On-wine	1.9	2.3	1.3	2.4	1.8	1.3	1.0	3.6	7.9
On-spirits	-0.5	-0.6	-0.3	-0.4	-0.4	-0.7	-0.4	-0.7	-1.4
On-RTDs	0.3	0.3	0.3	0.1	0.0	0.7	0.0	0.7	2.6
Total	**-12.6**	**-21.1**	**-3.7**	**0.3**	**-12.4**	**-25.7**	**-2.6**	**-16.3**	**-133.6**
Absolute change in spending, £ per drinker per year									
Off-beer	0.2	0.5	-0.1	0.3	0.1	0.3	0.2	0.6	-0.9
Off-cider	-1.8	-2.6	-0.9	-0.8	-1.8	-2.7	-0.2	-2.1	-21.1
Off-wine	14.8	13.0	16.7	16.7	17.9	10.8	3.4	27.9	123.6
Off-spirits	-0.3	-0.5	-0.2	-0.5	-0.3	-0.2	0.1	-1.1	-3.8
Off-RTDs	-0.6	-0.2	-0.9	-0.2	-0.2	-1.2	-0.2	-0.9	-4.5
On-beer	-3.9	-7.1	-0.6	-2.9	-3.9	-4.9	-1.5	-6.9	-25.8
On-cider	0.3	0.6	0.1	0.2	0.3	0.5	0.1	0.6	2.2
On-wine	2.7	3.4	2.0	3.9	2.6	1.6	1.5	5.4	10.3
On-spirits	-1.3	-1.7	-1.0	-1.0	-1.2	-1.7	-1.1	-1.7	-3.6

On-RTDs	0.6	0.7	0.6	0.2	0.1	1.5	0.1	1.4	5.0
Total	**10.8**	**6.2**	**15.7**	**15.8**	**13.6**	**3.9**	**2.4**	**23.2**	**81.3**

Table 4.16 - Detailed socioeconomic and drinker group specific results for a 50p MUP

	SEC1 (highest)			SEC2			SEC3 (lowest)		
	Moderate	Increasing risk	High risk	Moderate	Increasing risk	High risk	Moderate	Increasing risk	High risk
Baseline statistics									
Baseline Consumption (units per week)	5.6	26.6	72.0	4.4	26.0	77.8	3.6	27.8	79.3
Population size (000,000s)	11.6	3.0	0.7	8.1	1.8	0.5	13.6	2.1	0.8
Baseline Consumption (drinker)	6.3	26.6	72.0	5.5	26.0	77.8	4.8	27.8	79.3
Drinker population (000,000s)	10.4	3.0	0.7	6.5	1.8	0.5	10.2	2.1	0.8
% drinkers	89.1%	100.0%	100.0%	79.7%	100.0%	100.0%	74.7%	100.0%	100.0%
Sales/consumption volume, units per drinker per year									
Off-beer	27.0	114.6	367.5	27.6	156.5	631.0	29.9	233.1	728.8
Off-cider	3.7	13.3	74.5	4.4	23.0	145.7	4.8	35.3	205.2
Off-wine	116.9	737.7	2274.1	101.9	630.8	2022.3	56.9	377.8	1516.0
Off-spirits	24.7	121.2	299.5	24.9	134.9	238.9	25.1	173.1	447.2
Off-RTDs	0.7	4.1	1.0	1.1	1.1	2.1	2.1	6.2	37.0
On-beer	89.8	259.2	561.3	77.1	299.4	879.2	88.2	485.9	927.3
On-cider	3.3	7.9	20.2	3.2	10.2	34.4	3.7	18.7	42.3
On-wine	45.9	102.5	123.4	28.6	63.8	86.1	14.9	44.3	123.8
On-spirits	17.0	22.4	26.9	17.6	34.7	14.1	18.8	47.6	56.8
On-RTDs	1.4	3.5	3.3	2.5	1.1	1.5	4.2	27.1	52.1
Total	**330.4**	**1386.4**	**3751.7**	**288.8**	**1355.5**	**4055.2**	**248.6**	**1449.1**	**4136.4**
Spending, £ per drinker per year									
Off-beer	14.6	56.9	169.9	14.5	75.1	276.3	15.4	110.6	321.8
Off-cider	1.9	6.3	29.1	2.2	9.9	54.1	2.3	14.8	72.5
Off-wine	77.8	467.9	1444.2	63.5	372.9	1153.4	34.4	220.2	752.9
Off-spirits	14.8	70.3	160.1	14.7	74.5	123.1	14.5	93.4	225.9
Off-RTDs	0.7	4.1	0.9	1.1	1.2	2.1	2.4	6.6	35.5
On-beer	131.3	354.8	729.6	109.2	398.3	1120.6	123.0	638.1	1170.0
On-cider	4.7	10.8	27.6	4.3	13.6	43.9	5.0	24.1	51.2
On-wine	74.6	161.0	193.8	43.6	94.8	129.7	22.2	65.3	101.8
On-spirits	50.7	65.8	76.7	50.7	91.2	39.4	52.1	123.1	141.0
On-RTDs	3.0	7.5	6.4	5.4	2.2	3.2	8.7	55.6	97.5
Total	**374.2**	**1205.4**	**2838.2**	**309.4**	**1133.6**	**2945.9**	**280.0**	**1351.7**	**2970.2**
After intervention / change from baseline									
Changes in consumption (units per drinker)	0.0	0.1	0.0	0.0	-0.3	-2.5	-0.1	-0.9	-4.7
Changes in consumption (%)	-0.2%	0.3%	0.0%	-0.8%	-1.0%	-3.2%	-2.0%	-3.2%	-5.9%
Final Consumption (drinker)	6.3	26.7	71.9	5.5	25.7	75.3	4.7	26.9	74.7
Absolute change in sales/consumption volume, units per drinker per year									
Off-beer	-1.5	-10.9	-52.7	-1.8	-17.6	-115.9	-2.1	-27.5	-121.8
Off-cider	-0.9	-4.4	-36.4	-1.1	-9.7	-80.6	-1.4	-15.4	-128.8
Off-wine	2.6	27.2	122.1	2.2	25.8	104.4	1.2	15.1	75.9
Off-spirits	-1.0	-8.3	-28.7	-1.1	-10.3	-25.2	-1.2	-13.3	-46.6
Off-RTDs	-0.1	-0.6	-0.3	-0.1	-0.3	-0.5	-0.3	-1.5	-11.8
On-beer	-1.0	-3.6	-13.7	-0.9	-4.8	-21.6	-1.3	-8.5	-25.3
On-cider	0.1	0.3	1.0	0.1	0.4	1.8	0.1	0.8	2.2
On-wine	1.5	4.5	8.0	0.9	3.4	6.7	0.5	2.4	8.9
On-spirits	-0.3	-0.3	-0.9	-0.3	-0.9	-0.4	-0.5	-0.9	-2.6
On-RTDs	0.0	0.2	0.2	0.0	0.1	0.1	0.1	1.8	6.6
Total	**-0.7**	**4.1**	**-1.2**	**-2.2**	**-14.0**	**-131.1**	**-4.9**	**-47.0**	**-243.3**
Absolute change in spending, £ per drinker per year									
Off-beer	0.2	0.5	0.4	0.2	0.6	-2.8	0.2	0.9	-0.9
Off-cider	-0.2	-1.0	-8.5	-0.2	-2.3	-19.4	-0.3	-3.6	-32.2
Off-wine	4.1	31.5	139.1	3.9	31.1	140.7	2.3	19.9	99.2
Off-spirits	0.0	-1.4	-4.0	0.2	-1.1	-3.1	0.1	-0.7	-3.8
Off-RTDs	-0.1	-0.6	-0.2	-0.2	-0.3	-0.5	-0.3	-1.6	-11.3
On-beer	-1.4	-4.8	-17.0	-1.3	-6.1	-27.3	-1.8	-10.6	-31.4
On-cider	0.1	0.4	1.4	0.1	0.6	2.3	0.2	1.0	2.8

On-wine	2.4	7.0	12.5	1.4	5.0	10.0	0.7	3.5	8.5
On-spirits	-0.9	-1.0	-2.4	-0.9	-2.2	-1.2	-1.3	-2.4	-6.3
On-RTDs	0.0	0.5	0.5	0.1	0.1	0.3	0.2	3.7	12.5
Total	**4.2**	**31.1**	**121.6**	**3.2**	**25.4**	**98.9**	**0.1**	**10.1**	**37.2**

4.2 National IBA policy results

This section contains results for 6 main policy scenarios:

- 100% of patients receive an IBA when they next register with a new GP (NR100%)
- 10% of patients receive an IBA when they next visit their GP (NC10%)
- 20% of patients receive an IBA when they next visit their GP (NC20%)
- 30% of patients receive an IBA when they next visit their GP (NC30%)
- 40% of patients receive an IBA when they next visit their GP (NC40%)
- 100% of patients receive an IBA when they next visit their GP (NC100%)

In all of these scenarios we assume all practitioners use the full AUDIT questionnaire with a threshold of 8 to identify patients at risk, in line with NICE guidance (2).

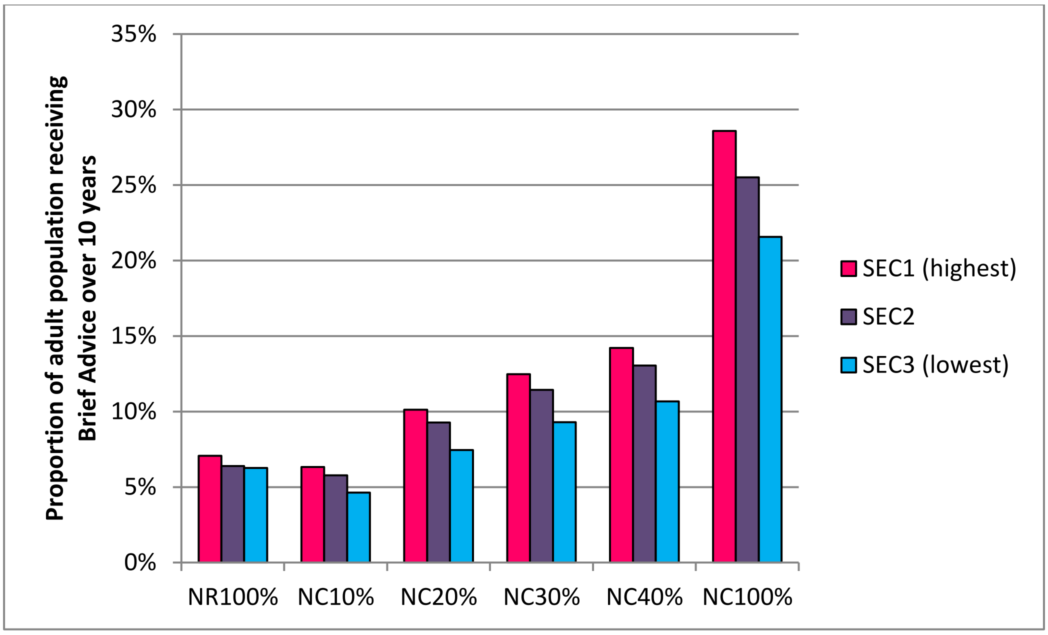
4.2.1 IBA delivery

Table 4.17 presents the estimated volume of AUDIT questionnaires and Brief Advice sessions delivered over the 10 years of implementation for each of the modelled IBA policies. As we do not assume any socioeconomic gradient in primary care attendance, the AUDIT coverage rates do not vary between socioeconomic groups, however there are socioeconomic differences in BA coverage due to the differential alcohol consumption patterns across the population. This gradient is illustrated in Figure 4.17.

Table 4.17 - Population volumes of IBA delivery under modelled policies in primary care

		Population	SEC1 (highest)	SEC2	SEC3 (lowest)
Baseline population		35,477,928	12,989,027	8,704,019	13,784,882
Total patients receiving AUDIT questionnaire	NR100%	6,995,942	2,548,428	1,648,947	2,798,567
	NC10%	7,082,950	2,511,255	1,793,747	2,777,947
	NC20%	11,297,647	4,016,142	2,859,334	4,422,172
	NC30%	13,776,394	4,916,092	3,482,703	5,377,599
	NC40%	15,566,765	5,573,238	3,916,164	6,077,363
	NC100%	29,908,890	10,847,477	7,434,206	11,627,207
Total patients receiving Brief Advice	NR100%	2,338,423	918,222	555,454	864,747
	NC10%	1,960,472	820,541	502,486	637,445
	NC20%	3,150,411	1,315,537	807,466	1,027,408
	NC30%	3,896,992	1,620,031	996,164	1,280,796
	NC40%	4,452,477	1,845,239	1,135,482	1,471,756
	NC100%	8,906,600	3,713,160	2,219,675	2,973,765

Figure 4.17 - Modelled Brief Advice coverage by socioeconomic group



4.2.2 Impacts on health outcomes

The estimated impact of each modelled IBA scenario on deaths and hospital admissions (using the broad measure) are presented in Table 4.18 and Table 4.19 respectively. Note that as, unlike MUP policies, the impact of IBAs on alcohol consumption decays over time, there is no 'full effect' for IBA policies. We therefore present health outcomes for all IBA policies as cumulative changes over 20 years following policy implementation.

These results show that whilst the greatest absolute reductions in health harms occur in the lowest socioeconomic groups, it is the highest socioeconomic group who experience the greatest relative reduction. This difference is illustrated clearly for alcohol-related deaths in Figure 4.18 and Figure 4.19. The same pattern is observed in the results for hospital admissions.

Table 4.18 - Modelled impact of IBA policies on cumulative alcohol-attributable deaths over 20 years

		Population	SEC1 (highest)	SEC2	SEC3 (lowest)
Expected alcohol-attributable deaths over 20 years (no IBAs)		129,380	33,502	27,835	68,043
Cumulative change in deaths over 20 years	NR100%	-2,430	-781	-575	-1,073
	NC10%	-2,275	-815	-577	-883
	NC20%	-3,529	-1,271	-889	-1,370
	NC30%	-4,156	-1,490	-1,036	-1,630
	NC40%	-4,605	-1,648	-1,146	-1,811
	NC100%	-8,835	-3,148	-2,194	-3,493
Relative change in total alcohol-attributable deaths over 20 years	NR100%	-1.9%	-2.3%	-2.1%	-1.6%
	NC10%	-1.8%	-2.4%	-2.1%	-1.3%
	NC20%	-2.7%	-3.8%	-3.2%	-2.0%
	NC30%	-3.2%	-4.4%	-3.7%	-2.4%
	NC40%	-3.6%	-4.9%	-4.1%	-2.7%
	NC100%	-6.8%	-9.4%	-7.9%	-5.1%

Table 4.19 - Modelled impact of IBA policies on cumulative alcohol-attributable hospital admissions over 20 years

		Population	SEC1 (highest)	SEC2	SEC3 (lowest)
Expected alcohol-attributable hospital admissions over 20 years (no IBAs)		14,611,686	4,498,259	3,210,370	6,903,057
Cumulative change in hospital admissions over 20 years	NR100%	-124,954	-35,356	-28,913	-60,684
	NC10%	-104,378	-34,197	-26,377	-43,804
	NC20%	-161,317	-53,112	-40,608	-67,597
	NC30%	-190,081	-62,313	-47,303	-80,465
	NC40%	-211,375	-69,092	-52,367	-89,916
	NC100%	-396,623	-129,790	-98,128	-168,704
Relative change in total alcohol-attributable hospital admissions over 20 years	NR100%	-0.9%	-0.8%	-0.9%	-0.9%
	NC10%	-0.7%	-0.8%	-0.8%	-0.6%
	NC20%	-1.1%	-1.2%	-1.3%	-1.0%
	NC30%	-1.3%	-1.4%	-1.5%	-1.2%
	NC40%	-1.4%	-1.5%	-1.6%	-1.3%
	NC100%	-2.7%	-2.9%	-3.1%	-2.4%

Figure 4.18 - Cumulative change in deaths over 20 years for modelled IBA scenarios

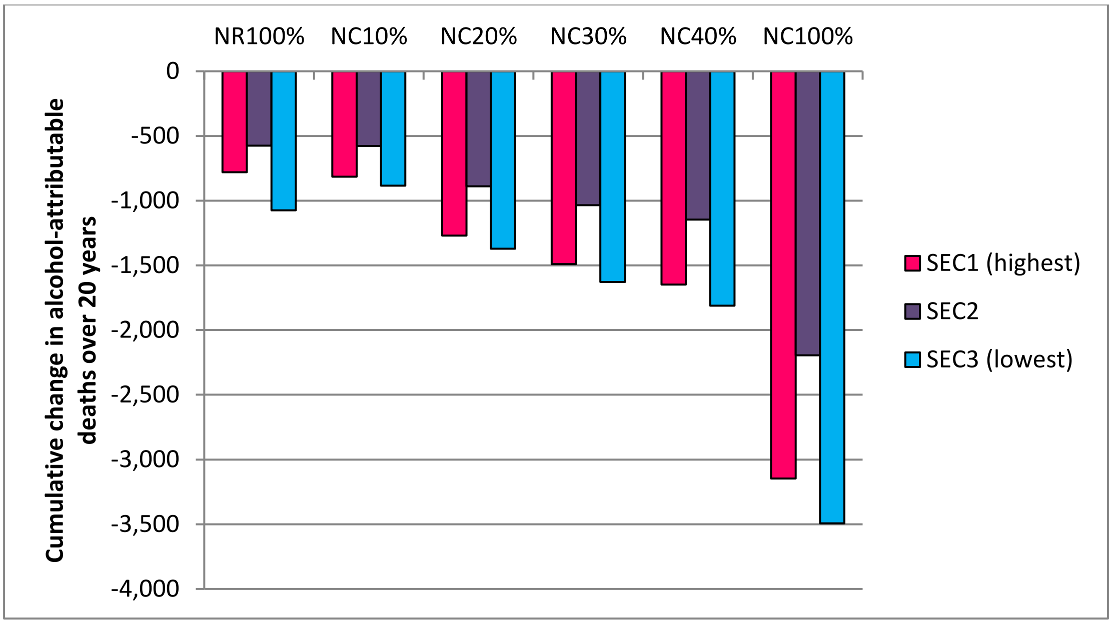
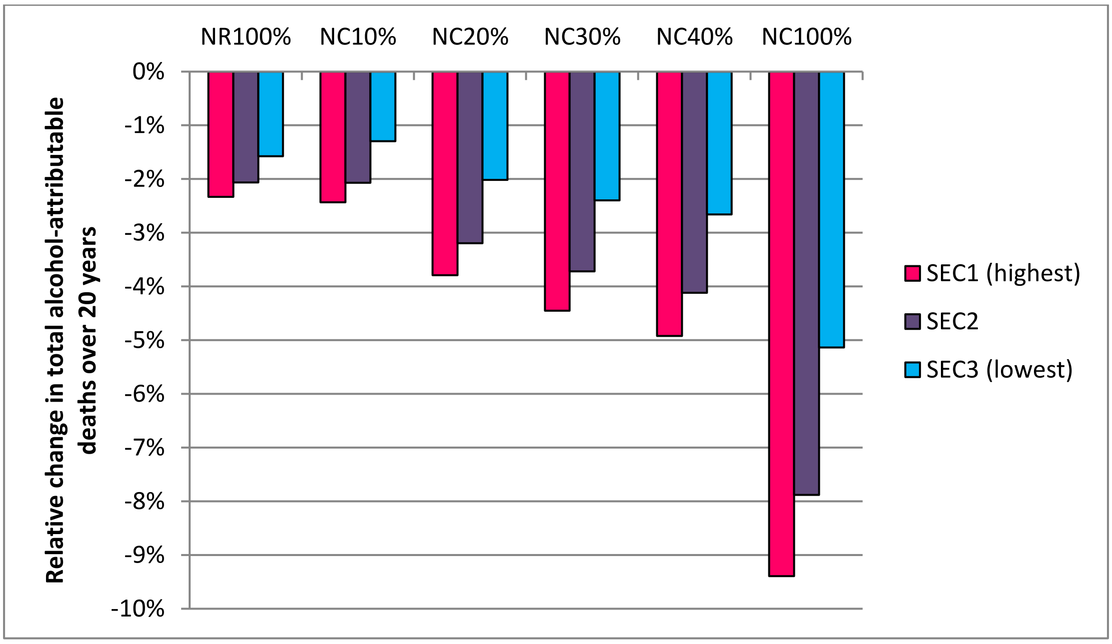


Figure 4.19 - Relative change in deaths over 20 years for modelled IBA scenarios



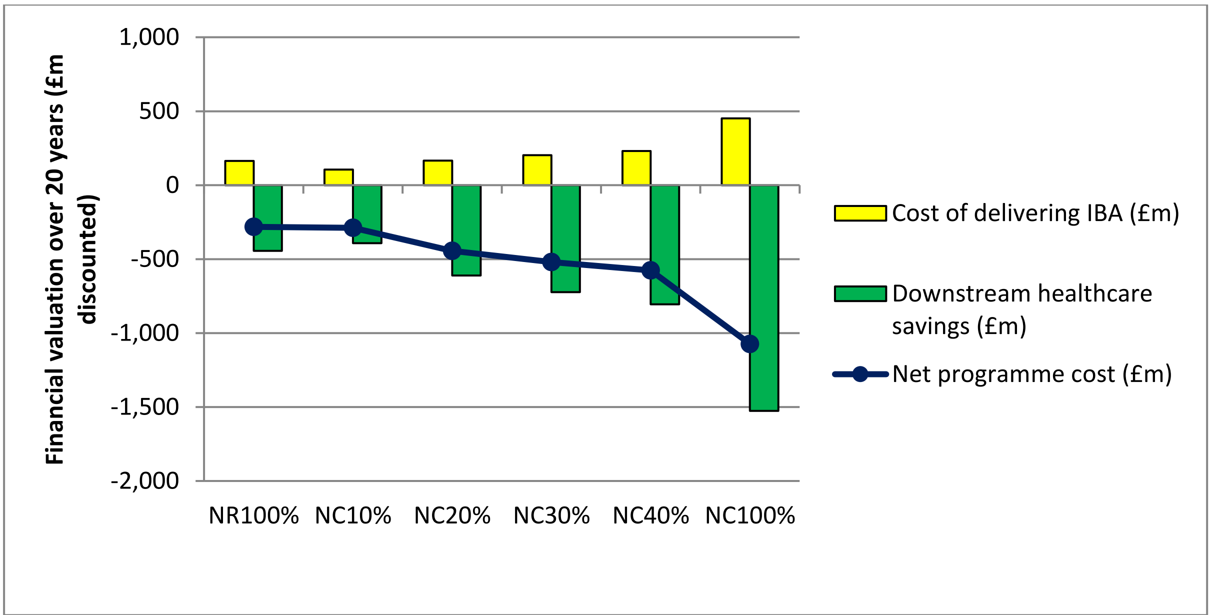
4.2.3 Policy costs and cost-effectiveness

The long-term implementation costs, future healthcare savings, QALY gains and cost-effectiveness results for all modelled IBA scenarios are shown in Table 4.20. These results show that all 6 policies are estimated to be overall cost-saving, as illustrated in Figure 4.20, and health improving compared to no delivery of IBAs in primary care. Whilst all policies are cost-saving in the long-term over the 20 year time horizon of the model, much of the healthcare savings are not accrued until after the initial outlay has been made in terms of staff costs to deliver the IBAs. This has important implications for policy makers and is illustrated in Figure 4.21 for the Next Registration scenario, showing that the programme does not break even until year 5. Results for other modelled scenarios are similar.

Table 4.20 - Summary of policy costs and savings (both discounted) for modelled IBA scenarios

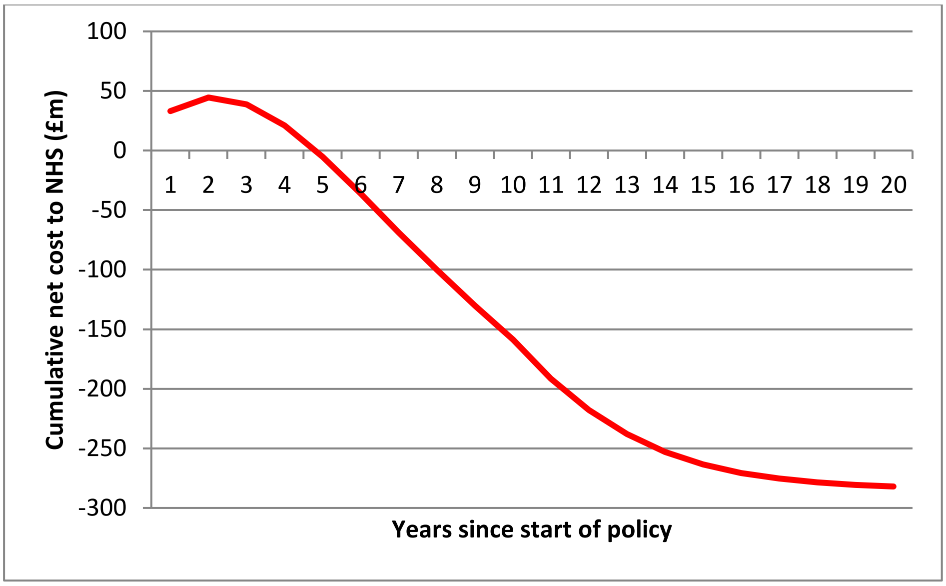
	Cost of delivering IBA (£m)	Downstream healthcare savings (£m)	Net programme cost (£m)	Total QALY gains over 20 years (000s)	Incremental Cost-Effectiveness Ratio (ICER)
NR100%	163.2	-445.1	-282.0	27.0	Dominates[7]
NC10%	104.4	-392.1	-287.7	25.7	Dominates
NC20%	165.1	-610.2	-445.1	40.2	Dominates
NC30%	202.8	-722.9	-520.1	47.7	Dominates
NC40%	231.1	-806.4	-575.3	53.3	Dominates
NC100%	451.6	-1525.2	-1073.6	102.0	Dominates

Figure 4.20 - Long term costs of modelled IBA scenarios in primary care



[7] A programme 'dominating' means that the programme is both cost-saving and health-improving in comparison to the counterfactual (in this case no IBA delivery)

Figure 4.21 - Cumulative net cost to NHS over time of Next Registration scenario



4.2.4 Sensitivity analyses

We examined the impact of using alternative identification tools and thresholds on the overall model results. In addition to the standard AUDIT questionnaire with a threshold of 8 (our base case) we modelled AUDIT-C with a threshold of 5 both alone and as a pre-screen before delivering the full AUDIT. We also modelled the use of FAST as a pre-screen to the full AUDIT questionnaire. A summary of the model results is presented in Table 4.21, showing that there is little to choose between the modelled options. The most expensive option, and the one with the greatest net monetary benefit, is the use of AUDIT-C alone. Essentially this is driven by the relatively low specificity of this identification tool which leads to a large number of 'false positives' (i.e. patients receiving a BA who are not drinking at risky levels), although delivering BAs to these patients is still estimated to be cost-effective.

Table 4.21 - Summary of impact of alternative identification tools on model outcomes

	Next GP registration (100%)				**Next GP consultation (100%)**			
Identification tool(s) and threshold(s)	Baseline (AUDIT 8)	AUDIT-C 5	AUDIT-C 5 > AUDIT 8	FAST 3 > AUDIT 8	Baseline (AUDIT 8)	AUDIT-C 5	AUDIT-C 5 > AUDIT 8	FAST 3 > AUDIT 8
Total patients receiving identification questionnaire (000,000s)	7.0	7.0	7.0	7.0	29.9	29.9	29.9	29.9
Total BAs delivered (000,000s)	2.3	3.5	2.2	2.1	8.9	13.7	8.5	8.0
Screening cost (£m)	163.2	199.0	149.2	138.0	451.6	558.0	409.2	369.7
Healthcare costs (£m)	-445.1	-528.9	-438.1	-390.2	-1,525.2	-1,845.0	-1,492.5	-1,339.2
Net cost (£m)	-282.0	-329.9	-288.9	-252.2	-1,073.6	-1,287.0	-1,083.2	-969.6
QALY gains (000s)	27.0	31.7	26.5	23.6	102.0	120.1	99.7	89.5
ICER versus no IBAs	Dominates	Dominates	Dominates	Dominates	Dominates	Dominates	Dominates	Dominates
Net Monetary Benefit (£m)[8]	822.1	963.2	819.7	724.2	3,113.5	3,688.7	3,077.8	2,759.6

[8] Net monetary benefit is calculated as the net cost saving added to a financial valuation of the QALY gains (calculated here assuming a QALY valuation of £20,000)(76)

4.3 IBA in NHS Health Checks results

4.3.1 Baseline results (scenario A)

In the baseline scenario, which is our best representation of current practice, 6.16million health checks are estimated to be delivered over 5 years. Within these, 1.76million patients are estimated to be identified as at risk due to their drinking and receive Brief Advice, leading to 1860 fewer deaths and 86,000 fewer alcohol-attributable hospital admissions over 20 years. These figures are presented in Table 4.22. Whilst these results show relatively similar absolute reductions in harm outcomes between the highest and lowest socioeconomic groups, once these are adjusted for the different baseline population sizes as shown in Table 4.23, those in the lowest socioeconomic group experience the greatest gains, in spite of receiving fewer Brief Advice sessions. This gradient is illustrated for QALYs (a composite measure of deaths averted and reduced morbidity) in Figure 4.22.

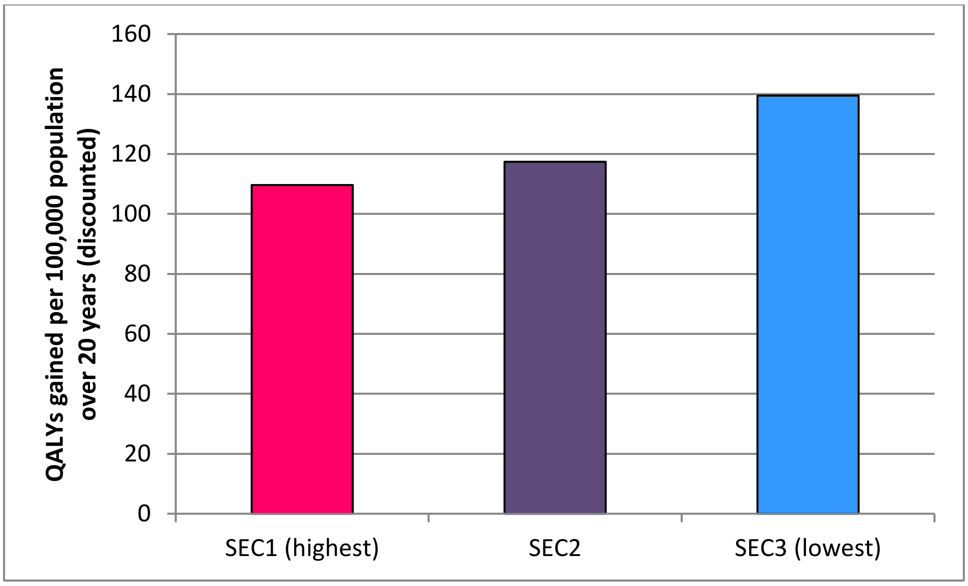
Table 4.22 - Summary health outcomes for baseline model

	Population	**SEC1 (highest)**	**SEC2**	**SEC3 (lowest)**
Baseline population	15.07	6.12	3.99	4.87
Total patients receiving identification questionnaire (000,000s)	6.16	2.44	1.67	2.05
Total BAs delivered (000,000s)	1.76	0.85	0.47	0.44
Cumulative change in alcohol-related deaths over 20 years	-1855	-747	-480	-629
Cumulative change in alcohol-related hospital admissions over 20 years (000s)	-85.74	-31.05	-22.74	-31.95
Total QALY gains over 20 years (000s)	17.52	6.71	4.69	6.79

Table 4.23 - Population-adjusted health outcomes by socioeconomic group

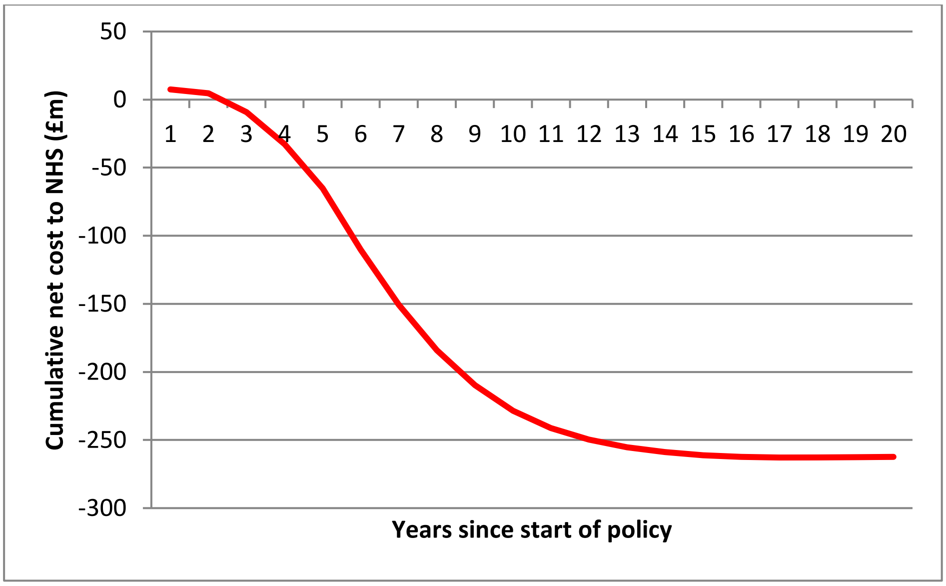
	SEC1 (highest)	**SEC2**	**SEC3 (lowest)**
BAs delivered per 100,000 population	13,830	11,736	9,061
Alcohol-related deaths averted per 100,000 population over 20 years	-12.2	-12.0	-12.9
Alcohol-related hospital admissions averted per 100,000 population over 20 years	-507.3	-569.4	-656.2
QALYs gained per 100,000 population over 20 years	109.6	117.4	139.5

Figure 4.22 - Distribution of health benefits by socioeconomic group



The total estimated cost of delivering IBAs over 5 years is £35m, which is offset by savings in NHS healthcare costs of £298m over 20 years to give a net saving of £262m. Figure 4.23 illustrates that the programme would cost approximately £7m in the short-term, before significant downstream savings in the costs of treating alcohol-related health conditions are experienced, with the programme breaking even after 3 years.

Figure 4.23 - Cumulative net cost of IBAs in health checks over time



Overall these results show that the inclusion of IBAs within the NHS Health Checks is likely to be both cost-saving and health-improving, as well as leading to a moderate reduction in alcohol-related health inequalities in 40-74 year olds.

4.3.2 Alternative modelling assumptions

4.3.2.1 Socioeconomic and consumption gradients in uptake (scenarios B, C & D)

Using evidence from Artac et al which suggests that there is a positive socioeconomic gradient in uptake of Health Check invitations (24) has almost no impact on the estimated effects of the policy (scenario B). Alternatively, using evidence from Cochrane et al which suggests a negative gradient (22) (scenario C), we estimate a marginal increase in coverage, with an additional 46,000 risky drinkers identified at an additional cost of £1.1m compared to baseline, leading to an additional 423 QALYs saved and an associated increase health care savings of £6.6m over 20 years.

Assuming that heavier drinkers are less likely to take up an invitation (scenario D) reduces the number of risky drinkers identified by 107,000, but with a corresponding reduction in IBA delivery costs of £2.5m compared to baseline. Overall QALY gains are 1,100 fewer than the baseline model, with an estimated £19m reduction in the net savings expected under the programme, although these savings are still substantial (£243m) and the programme is still estimated to be health-improving and cost-saving. Full results are shown in Table 4.24.

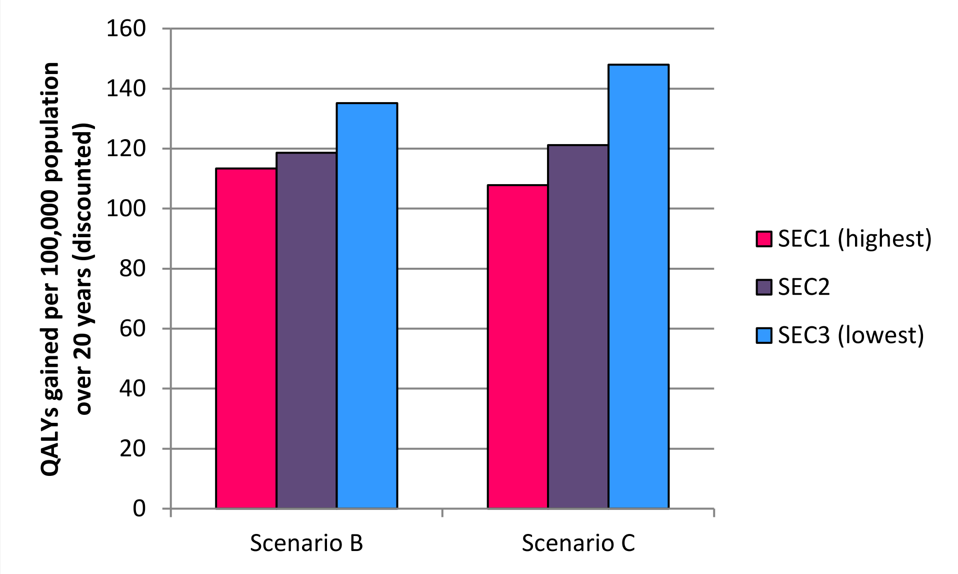
Table 4.24 - Model results for differential socioeconomic gradients in Health Check uptake rates

	Baseline	**Lower socioeconomic groups less likely to take up invitation**	**Lower socioeconomic groups more likely to take up invitation**	**Heavier drinkers less likely to take up invitation**
Scenario	A	B	C	D
Total Health Checks delivered (000,000s)	6.16	6.10	6.46	6.16
Total interventions delivered (000,000s)	1.76	1.76	1.80	1.65
Screening cost (£m)	35.13	35.21	36.19	32.61
Healthcare costs (£m)	-297.51	-298.92	-304.13	-278.11
Net cost (£m)	-262.38	-263.71	-267.94	-242.98
QALY gains (000s)	17.52	17.59	17.95	16.41
ICER versus no Health Check IBAs	Dominates	Dominates	Dominates	Dominates

Figure 4.24 illustrates that the impact of these alternative assumptions on the distribution of health benefits is small[9]; suggesting that the inequality-reducing impact of IBAs in the NHS Health Checks is primarily driven by baseline socioeconomic differences in rates of alcohol-related harm, rather than differential uptake rates.

[9] Note that for methodological reasons we are unable to produce an equivalent Figure for Scenario D, however it is highly likely that the conclusion would be similar

Figure 4.24 - Equity implications of alternative socioeconomic gradients on health benefits



4.3.2.2 More pessimistic estimates of effect of Brief Advice (scenarios E, F & G)

In order to examine the sensitivity of the model results to more pessimistic assumptions around the effectiveness of Brief Advice at reducing alcohol consumption, we have run a range of sensitivity analyses around both the reduction in alcohol consumption following a BA and the length of time for which any effect persists. Results of these alternative assumptions are shown in Table 4.25, which shows that whilst they reduce the change in alcohol consumption, healthcare savings and QALY gains, IBAs in the NHS Health Checks are still estimated to be cost-saving compared to no IBA delivery.

Table 4.25 - Model results for alternative assumptions of effectiveness for Brief Advice

	Baseline	**Brief Advice less effective (5.9%)**	**Effect of Brief Advice lasts less long (3 years)**	**Brief Advice less effective and lasts less long (5.9% & 3 years)**
Scenario	A	E	F	G
Total Health Checks delivered (000,000s)	6.16	6.16	6.16	6.16
Total interventions delivered (000,000s)	1.76	1.76	1.76	1.76
Screening cost (£m)	35.13	35.05	35.09	35.07
Healthcare costs (£m)	-297.51	-148.95	-132.71	-66.71
Net cost (£m)	-262.38	-113.90	-97.61	-31.64
QALY gains (000s)	17.52	8.73	7.99	4.00
ICER versus no Health Check IBAs	Dominates	Dominates	Dominates	Dominates

4.3.3 Alternative implementation scenarios

4.3.3.1 Alternative identification tools (scenarios H & I)

Our baseline assumption is that all patients are screened with AUDIT-C with a threshold of 5+, followed by the full AUDIT with a threshold of 8+; however the best practice guidance also recommends the use of FAST with a threshold of 3+ as an initial screen prior to the full AUDIT. We have modelled this alternative, as well as exploring the impact of using the AUDIT-C initial screening alone (i.e. all individuals scoring 5+ on the AUDIT-C receive Brief Advice without being asked the remaining AUDIT questions). Results for these scenarios are shown in Table 4.26, showing that AUDIT-C alone is less specific and results in substantially more Brief Advice sessions being delivered than either of the screening pathways recommended in current guidance. The use of FAST rather than AUDIT-C as an initial screening tool leads to more Brief Advice sessions being delivered, but fewer QALY gains.

Table 4.26 - Model results for alternative screening tools

	Baseline	**Attendees screened with AUDIT-C only (5+)**	**Attendees screened with FAST (3+) followed by AUDIT (8+)**
Scenario	A	H	I
Total Health Checks delivered (000,000s)	6.16	6.16	6.16
Total interventions delivered (000,000s)	1.76	2.97	1.80
Screening cost (£m)	35.13	44.67	28.62
Healthcare costs (£m)	-297.51	-371.54	-274.63
Net cost (£m)	-262.38	-326.87	-246.00
QALY gains (000s)	17.52	21.45	16.07
ICER versus no Health Check IBAs	Dominates	Dominates	Dominates

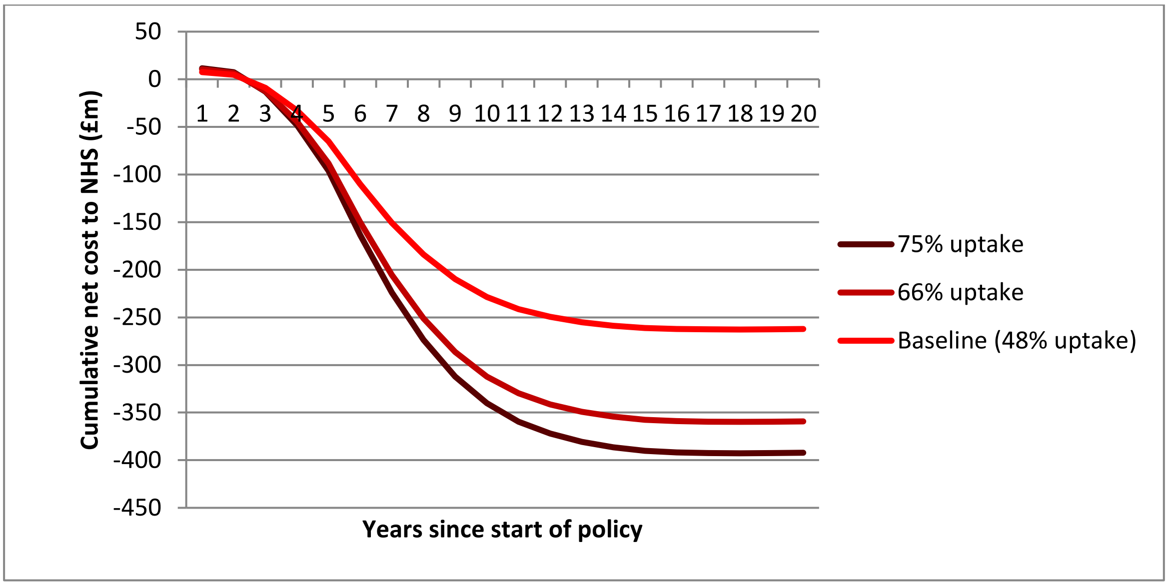
4.3.3.2 Increased uptake rates (scenarios J & K)

Table 4.27 presents the model results for scenarios J and K, in which uptake rates are increased to 66% and 75% in line with PHE targets to improve coverage of the NHS Health Checks across the eligible population. These results show that increasing the uptake rate is estimated to both increase health gains and cost savings in the long term, although initial implementation costs are higher, as illustrated in Figure 4.25. Assuming a willingness-to-pay threshold of £20,000/QALY these results suggest that an initiative which increased uptake to 66% from current levels would be cost-effective if it cost less than £228m. Similarly, spending up to £309m to increase uptake rates from current levels to 75% would be considered cost-effective.

Table 4.27 - Model results for increased uptake rates

	Baseline (48% uptake)	66% uptake	75% uptake
Scenario	A	J	K
Total Health Checks delivered (000,000s)	6.16	8.48	9.41
Total interventions delivered (000,000s)	1.76	2.43	2.73
Screening cost (£m)	35.13	48.47	54.24
Healthcare costs (£m)	-297.51	-407.69	-446.50
Net cost (£m)	-262.38	-359.22	-392.26
QALY gains (000s)	17.52	24.07	26.47
ICER versus no Health Check IBAs	Dominates	Dominates	Dominates

Figure 4.25 - Cumulative net cost of different uptake rates for Health Check IBAs



5 DISCUSSION

5.1 Summary of results

5.1.1 Minimum Unit Pricing results

In common with previous studies, the results of the modelling work presented in this report show that MUP policies are an effective and well-targeted measure to reduce alcohol-related harms (8,9,67,68). The greatest impact in terms of reduced alcohol consumption is in the heaviest drinkers who drink the cheapest alcohol which is affected by the introduction of a minimum price threshold. In particular the greatest impact is in high risk drinkers in the lowest socioeconomic groups, who are those suffering the greatest alcohol-related harms and who stand to gain the most from reducing their drinking.

A 50p MUP is estimated to lead to a 1.8% reduction in average alcohol consumption, a 4.3% reduction in annual alcohol-related deaths and a 2.7% reduction in alcohol-related hospital admissions (3.1% using the narrow measure). Over 20 years following implementation the policy would confer societal benefits valued at £8.4bn (£5.8bn using the narrow measure).

5.1.2 National IBA policy results

As with previous studies (12,69), the results of the modelling work reported here show that national IBA policies are highly likely to lead to significant health benefits whilst generating a substantial net saving for the NHS. Fully implemented, a programme of delivering IBAs to all patients who register with a new GP (in line with current NICE guidance (2)) is estimated to generate 27,000 additional QALYs over 20 years whilst generating a long-term saving of £282m over the same period. Extending this programme to deliver IBA to all patients at their next GP consultation would bring considerably greater benefits (102,000 QALYs and a net saving of £1.1bn). Whilst 100% delivery is highly ambitious, even achieving a 30% delivery rate amongst GPs would lead to almost 50,000 additional QALYs and a net saving of over £0.5bn. The only concern which policy makers should be aware of is that large-scale national IBA programmes such as those modelled here will require significant up-front investment, with cost savings only realised several years down the line as the longer-term health benefits begin to be felt.

5.1.3 Health Check IBA results

The results of the modelling work presented in this report provide clear evidence that the inclusion of alcohol Identification and Brief Advice as part of the NHS Health Checks is both cost-saving and health-improving over the alternative of no IBA delivery. This conclusion is robust to a range of alternative assumptions around different uptake of Health Check invitations by different socioeconomic groups and the effectiveness and duration of effect of Brief Advice sessions. Modelling of increased uptake rates shows that this is likely to lead to even greater health gains and cost savings, even if significant investment was required to achieve this increase.

5.2 Impact on health inequalities

Whilst the impact of MUP policies on health inequalities has previously been studied in England (9), to our knowledge this is the first time that the impact of IBA policies on health inequalities has been quantified, although a recent study in Scotland came to similar conclusions that such policies were likely to lead to marginal improvements in socioeconomic differences in alcohol-related health (70). Whilst all policies modelled in this report are inequality reducing in some senses, it is informative to compare the scale of these reductions. Table 5.1 presents the cumulative alcohol-attributable deaths over 20 years per 100,000 population at baseline and for 4 key policy options:

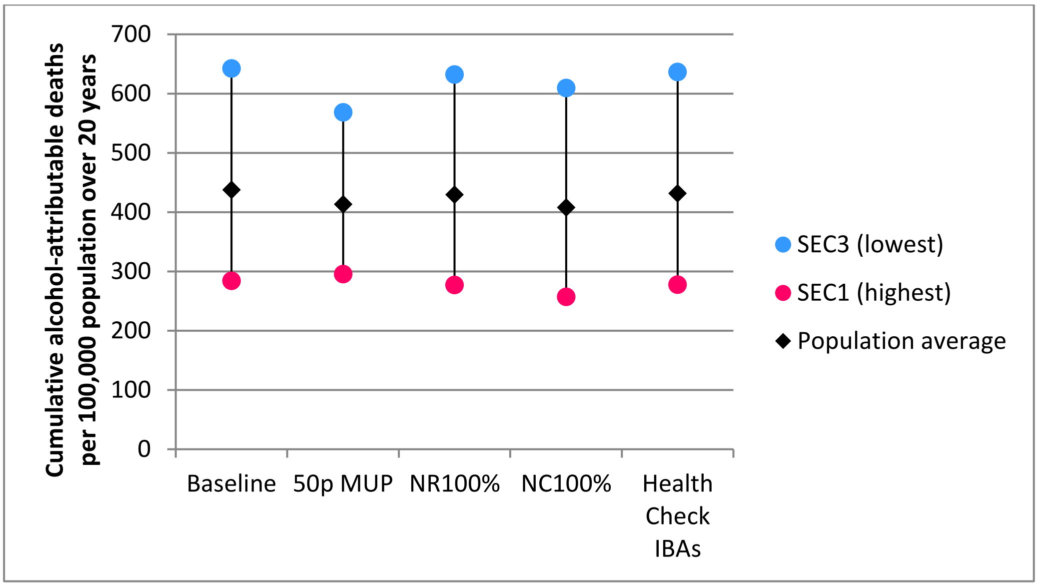
- A 50p minimum unit price
- A policy of delivering IBA to all adults when they register with a new GP
- A policy of delivering IBA to all adults at their next GP consultation
- A policy of delivering IBA to all 40-74 year olds attending an NHS Health Check

These figures show that all policies lead to reductions in deaths for all socioeconomic groups, however the scale of these reductions varies between policies and groups. Figure 5.1 illustrates this variation graphically. A common measure of absolute health inequalities is the Slope Index of Inequality (SII) (71), which is also shown in Table 5.1. This clearly indicates that a 50p MUP policy has a substantially greater impact in terms of reducing absolute inequality than any of the other modelled policy options, although it is not the policy with the largest overall impact on alcohol-related deaths (which is IBAs at 100% of next GP consultations). It is important to note, however, that IBA policies could in principal be targeted to more deprived areas, which would be likely to increase the inequality-reducing impact of the policy. Additionally, whilst results shown here are for alcohol-attributable deaths, the conclusions using alternative measures such as alcohol-attributable hospital admissions are the same.

Table 5.1 – Socioeconomic gradients in cumulative alcohol-attributable deaths per 100,000 population over 20 years for selected policies

	Population average	**SEC1 (highest)**	**SEC2**	**SEC3 (lowest)**	**Slope index of inequality**
Baseline	438	284	389	642	-432
50p MUP	413	295	379	568	-315
NR100%	430	277	381	632	-429
NC100%	408	257	358	609	-432
Health Check IBAs	432	278	382	636	-434

Figure 5.1 - Impact on socioeconomic inequalities in alcohol-related deaths of selected modelled policies



5.3 Considerations for setting an MUP threshold

An important consideration for policy makers who may be contemplating the introduction of an MUP policy is how to establish the correct level at which the initial minimum price threshold should be set. Below we set out two potential approaches; one based on desired outcomes and a second based on *a priori* judgements regarding the problem to be addressed.

A policy maker may decide that an alcohol-related outcome of interest (e.g. alcohol-related deaths of the proportion of the population who are drinking above lower risk guidelines) is too high. They may then specify a target reduction either in relative terms (e.g. a reduction in annual alcohol-related deaths of 5%), in absolute terms (e.g. to reduce the annual number of alcohol-related deaths by 1,000) or by specifying a target level of harm (e.g. 5,000 or fewer alcohol-related deaths per year). In each case, the policy maker may wish to know the level of MUP which would be required to achieve their aim and SAPM can provide evidence on this point. For example, if the desired outcome is a 5% reduction in alcohol-related deaths, then the results presented in Table 4.5 suggest an MUP of around 52p would be required. SAPM cannot identify the harm to be reduced or the appropriate level of reduction as this will reflect the interests, aspirations and values of the policy maker; however, it can provide evidence on the trade-offs which may be made. For example, policy makers may be tempted to seek ever greater reductions in alcohol-related harm by positing ever higher MUPs. While this may have public health benefits, unintended consequences may occur and Figure 4.1, Figure 4.5 and Figure 4.9 demonstrate that although harm reductions increase in line with the MUP threshold, impacts on the consumption and spending of moderate drinkers also increase. This may be something policy makers wish to avoid and they may wish to balance this against public health gains in their decision-making regarding an appropriate MUP threshold. SAPM provides evidence on a wide range of outcome measures as documented in this and earlier reports (8,11) and this provides evidence for policy makers to judge which MUP threshold may best achieve their aim.

A second approach is for policy makers to identify *a priori* that a particular aspect of the alcohol market is problematic. For example, it may be argued that alcohol should never be sold 'too cheaply' under some definition of 'too cheaply', for example less than £1 for a pint of normal strength beer. Alternatively, it may be argued for example that the cheapest 10% of products are problematic as they are disproportionately purchased by the heaviest drinkers. In each case, a model such as SAPM is not required to select the MUP threshold and this is either implicit or can be derived from price distribution such as those shown in Figure 3.3. Again, there is no valid empirical basis, outside of stakeholder opinion, available for determining what constitutes 'too cheap' or what exact percentage of products are problematic and we would caution against seeking to construct one as this will inevitably reflect the perspectives of the analyst and not objective realities.

When taking either approach to selecting an MUP threshold, it is both appropriate and necessary to draw on the subjective judgements of key stakeholders. There is no 'correct' mechanism for selecting a specific MUP threshold, although tools such as SAPM may be useful in order to allow policy makers to establish the likely scale of impacts on a range of outcomes of interest to them. Fundamentally, as is the case with any policy decision, policy makers must balance the perceived benefits of the policy against any perceived negative impacts. Different stakeholders may apply different weight to different positive and negative aspects, or even disagree on whether some consequences of the policy are positive or negative at all. It is therefore recommended that policy makers explain their subjective judgements and draw on evidence of the potential effects on outcomes of interest when explaining their decisions regarding preferences for a particular MUP threshold.

5.4 Limitations

As with any modelling study there are a number of limitations which should be considered when interpreting the results set out in this report. The strengths and limitations of the MUP model have been discussed at length elsewhere (e.g. (8,9)) and we will therefore focus on the limitations of the IBA modelling here. The most important of these is how closely the modelled scenarios represent actual practice. Whilst we have assumed that best practice guidelines are followed in all cases, it may be the case that not all patients attending a Health Check receive an assessment of their drinking, or those that do and who are identified as being at risk may not receive Brief Advice. Data from the recent ODHIN trial for England (72) suggests that only 86% of patients who were identified as risky drinkers using AUDIT-C went on to receive any form of advice about their drinking from their doctor. The assumption that an individuals' probability of attending a primary care or a Health Check is independent of their current drinking may also have an important impact on the model results, since heavy drinkers are exactly who the programme seeks to target. If heavy drinkers are less likely to take up a Health Check invitation then this would limit the effectiveness of the IBA programme. We were unable to identify any evidence on this relationship; however an exploratory sensitivity analysis suggests that it may not have a substantial impact. There is also some limited evidence that heavy drinkers attend primary care more frequently, which may suggest that these concerns may be unfounded (73).

Another important limitation is the fact that we have modelled a single 10 year implementation period for national IBA policies and a 5 year cycle of Health Checks, whereas in both principal and practice patients may receive multiple IBAs within the 20 year horizon of the model. There is little published evidence on the impact of repeated Brief Advice sessions over time and it is therefore unclear whether the receipt of multiple interventions would serve to reinforce each other, leading to greater benefits, or whether the marginal impact of subsequent Brief Advice sessions would be less than the first.

It is also important to consider that the Health Check itself seeks to identify a patient's cardiovascular risk and treat patients identified as being at high risk of harm. A number of cardiovascular conditions, such as hypertension, also have an alcohol-attributable component and it is therefore possible that any treatment given for these conditions will reduce the individual's alcohol-related health risks without changing their alcohol consumption. Alternatively, it is plausible that the identification of a serious cardiovascular risk may in itself act as an intervention which leads to a reduction in alcohol consumption. The direction of the combined effect of these potential inter-relationships is unclear.

Another relevant consideration is that we have not accounted for differential effectiveness of Brief Advice across different subgroups of the eligible population as the evidence on this is either weak or inconclusive (74). Finally, the structure of SAPM introduces some limitations when analysing interventions which target particular age groups of the population. These issues are discussed in detail in Section 2.5.1.3 of Purshouse et al. (4), although the direction of effect (if any) that they may have is unclear and it is unlikely that they will have a substantive impact on the conclusions of the report.

5.5 Conclusions

This study provides clear evidence that:

- MUP policies are an effective and well-targeted measure for reducing alcohol-related harm
- Higher MUP thresholds lead to greater reductions in harm, however they increase the impact on moderate drinkers
- National-level IBA policies are highly likely to be health-improving and cost-saving
- The inclusion of IBAs as an ongoing part of the NHS Health Checks is highly likely to be health-improving and cost-saving
- Increasing uptake rates both amongst GPs delivering IBAs in general practice and patients receiving Health Check invitations, is likely to be cost-effective even if this involves significant investment
- Local policy makers should be mindful of the long- and short-term cost implications of IBA programmes
- MUP policies are likely to have a substantially greater impact in terms of reducing absolute socioeconomic inequalities in health than IBA policies, unless these are targeted at lower socioeconomic groups.

6 REFERENCES

1. Glover D, Henderson J. Quantifying health impacts of government policies. London; 2010.
2. National Institute of Health and Clinical Excellence (NICE). PH24 Alcohol-use disorders: preventing harmful drinking. 2010.
3. National Institute of Health and Clinical Excellence (NICE). Guide to the methods of technology appraisal 2013. 2013.
4. Purshouse R, Brennan A, Latimer N, Meng Y, Rafia R, Jackson R, et al. Modelling to assess the effectiveness and cost-effectiveness of public health related strategies and interventions to reduce alcohol attributable harm in England using the Sheffield Alcohol Policy Model version 2.0. Report to the NICE Public Health Programme Development Group. Sheffield; 2009.
5. Meng Y, Hill-McManus D, Brennan A, Meier P. Model-Based Appraisal of Alcohol Minimum Pricing and off-Licensed Trade Discount Bans in Scotland using the Sheffield Alcohol Policy Model (v.2): Second update based on newly available data. Report to the Scottish Government. Sheffield; 2012.
6. Hill-McManus D, Brennan A, Stockwell T, Giesbrecht N, Thomas G, Zhao J, et al. Model-Based Appraisal Of Alcohol Minimum Pricing In Ontario And British Columbia: A Canadian adaptation of the Sheffield Alcohol Policy Model Version 2. 2012.
7. Angus C, Scafato E, Ghirini S, Torbica A, Ferre F, Struzzo P, et al. Cost-effectiveness of a programme of screening and brief interventions for alcohol in primary care in Italy. BMC Fam Pract. 2014 Jan;15(1):26.
8. Meng Y, Brennan A, Holmes J, Hill-McManus D, Angus C, Purshouse R, et al. Modelled income group-specific impacts of alcohol minimum unit pricing in England 2014/15: Policy appraisals using new developments to the Sheffield Alcohol Policy Model (v2.5). 2013.
9. Holmes J, Meng Y, Meier PS, Brennan A, Angus C, Campbell-Burton A, et al. Effects of minimum unit pricing for alcohol on different income and socioeconomic groups: a modelling study. Lancet. 2014 May 10;383(9929):1655–64.
10. NHS Health Scotland. MESAS fourth annual report. 2014.
11. Meng Y, Brennan A, Purshouse R, Hill-McManus D, Angus C, Holmes J, et al. Estimation of own and cross price elasticities of alcohol demand in the UK-A pseudo-panel approach using the Living Costs and Food Survey 2001-2009. J Health Econ. 2014 Mar;34:96–103.
12. Purshouse R, Brennan A, Rafia R, Latimer NR, Archer RJ, Angus CR, et al. Modelling the cost-effectiveness of alcohol screening and brief interventions in primary care in England. Alcohol Alcohol. 2013 Sep 25;48(2):180–8.
13. Khadjesari Z, Marston L, Petersen I, Nazareth I, Walters K. Alcohol consumption screening of newly-registered patients in primary care: a cross-sectional analysis. Br J Gen Pract. 2013 Oct;63(615):e706-12.
14. Hamilton FL, Laverty AA, Gluvajic D, Huckvale K, Car J, Majeed A, et al. Effect of financial incentives on delivery of alcohol screening and brief intervention (ASBI) in primary care: longitudinal study. J Public Health (Oxf). 2014 Sep 26;36(3):450–9.
15. Netherlands Institute for Health Services Research. Netherlands Information Network of General Practice (LINH).
16. OECD. Health at a Glance: Europe 2014. 2014.
17. Kaner EFS, Beyer F, Dickinson HO, Pienaar E, Campbell F, Schlesinger C, et al. Effectiveness of brief alcohol interventions in primary care populations. Cochrane database Syst Rev Online.

Wiley Online Library; 2007;4(2):CD004148.

18. Fleming M, Mundt M, French M, Manwell L, Stauffacher E, Barry K. Brief Physician Advice for Problem Drinkers: Long-Term Efficacy and Benefit-Cost Analysis. Alcohol Clin Exp Res. 2002 Jan;26(1):36–43.

19. Curtis. PSSRU: Unit costs of health & social care 2013. Canterbury; 2013.

20. Department of Health, Public Health England. NHS health check programme: best practice guidance. London; 2013.

21. Public Health England. NHS Health Check - Longer Lives [Internet]. 2014 [cited 2014 Nov 10]. Available from: http://fingertips.phe.org.uk/nhs-health-check

22. Cochrane T, Gidlow CJ, Kumar J, Mawby Y, Iqbal Z, Chambers RM. Cross-sectional review of the response and treatment uptake from the NHS Health Checks programme in Stoke on Trent. J Public Health (Oxf). 2013 Mar;35(1):92–8.

23. Dalton ARH, Bottle A, Okoro C, Majeed A, Millett C. Uptake of the NHS Health Checks programme in a deprived, culturally diverse setting: cross-sectional study. J Public Health (Oxf). 2011 Sep;33(3):422–9.

24. Artac M, Dalton ARH, Majeed A, Car J, Huckvale K, Millett C. Uptake of the NHS Health Check programme in an urban setting. Fam Pract. 2013 Aug;30(4):426–35.

25. Rehm J, Baliunas D, Borges G. The relation between different dimensions of alcohol consumption and burden of disease: an overview. Addiction. 2010;105(5):817–43.

26. Rehm J, Mathers C. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. Lancet. 2009;373:2223–33.

27. Lönnroth K, Williams BG, Stadlin S, Jaramillo E, Dye C. Alcohol use as a risk factor for tuberculosis - a systematic review. BMC Public Health. 2008 Jan;8(1):289.

28. Tramacere I, Negri E, Bagnardi V, Garavello W, Rota M, Scotti L, et al. A meta-analysis of alcohol drinking and oral and pharyngeal cancers. Part 1: overall results and dose-risk relation. Oral Oncol. Elsevier Ltd; 2010 Jul;46(7):497–503.

29. Rota M, Bellocco R, Scotti L, Tramacere I, Jenab M, Corrao G, et al. Random-effects meta-regression models for studying nonlinear dose-response relationship, with an application to alcohol and esophageal squamous cell carcinoma. Stat Med. 2010 Nov 20;29(26):2679–87.

30. Fedirko V, Tramacere I, Bagnardi V, Rota M, Scotti L, Islami F, et al. Alcohol drinking and colorectal cancer risk: an overall and dose-response meta-analysis of published studies. Ann Oncol. 2011 Sep;22(9):1958–72.

31. Corrao G, Bagnardi V, Zambon A, La Vecchia C. A meta-analysis of alcohol consumption and the risk of 15 diseases. Prev Med (Baltim). 2004 May;38(5):613–9.

32. Islami F, Tramacere I, Rota M, Bagnardi V, Fedirko V, Scotti L, et al. Alcohol drinking and laryngeal cancer: overall and dose-risk relation--a systematic review and meta-analysis. Oral Oncol. Elsevier Ltd; 2010 Nov;46(11):802–10.

33. Key J, Hodgson S, Omar RZ, Jensen TK, Thompson SG, Boobis AR, et al. Meta-analysis of studies of alcohol and breast cancer with consideration of the methodological issues. Cancer causes Control CCC. 2006 Aug;17(6):759–70.

34. Samokhvalov A V, Irving H, Mohapatra S, Rehm J. Alcohol consumption, unprovoked seizures, and epilepsy: a systematic review and meta-analysis. Epilepsia. 2010 Jul;51(7):1177–84.

35. Taylor B, Irving HM, Baliunas D, Roerecke M, Patra J, Mohapatra S, et al. Alcohol and hypertension: gender differences in dose-response relationships determined through

systematic review and meta-analysis. Addiction. 2009 Dec;104(12):1981–90.

36. Kodama S, Saito K, Tanaka S, Horikawa C, Saito A, Heianza Y, et al. Alcohol consumption and risk of atrial fibrillation: a meta-analysis. J Am Coll Cardiol. Elsevier Inc.; 2011 Jan 25;57(4):427–36.

37. Patra J, Taylor B, Irving H, Roerecke M, Baliunas D, Mohapatra S, et al. Alcohol consumption and the risk of morbidity and mortality for different stroke types--a systematic review and meta-analysis. BMC Public Health. 2010 Jan;10(1):258.

38. Samokhvalov A V, Irving H, Rehm J. Alcohol consumption as a risk factor for pneumonia: a systematic review and meta-analysis. Epidemiol Infect. Cambridge University Press; 2010 Dec 1;138(12):1789–95.

39. Rehm J, Taylor B, Mohapatra S, Irving H, Baliunas D, Patra J, et al. Alcohol as a risk factor for liver cirrhosis: a systematic review and meta-analysis. Drug Alcohol Rev. 2010 Jul;29(4):437–45.

40. Irving HM, Samokhvalov A V, Rehm J. Alcohol as a risk factor for pancreatitis. A systematic review and meta-analysis. JOP. 2009 Jan;10(4):387–92.

41. Taylor BJ, Shield KD, Rehm JT. Combining best evidence: a novel method to calculate the alcohol-attributable fraction and its variance for injury mortality. BMC Public Health. 2011 Jan;11(1):265.

42. Baliunas DO, Taylor BJ, Irving H, Roerecke M, Patra J, Mohapatra S, et al. Alcohol as a risk factor for type 2 diabetes: A systematic review and meta-analysis. Diabetes Care. 2009 Nov 1;32(11):2123–32.

43. Roerecke M, Rehm J. The cardioprotective association of average alcohol consumption and ischaemic heart disease: a systematic review and meta-analysis. Addiction. 2012 Jul 21;107(7):1246–60.

44. Gunning-Schepers L. The health benefits of prevention: a simulation approach. Health Policy (New York). 1989 Jul;12(1–2):1–255.

45. Fillmore KM, Kerr WC, Stockwell T, Chikritzhs T, Bostrom A. Moderate alcohol use and reduced mortality risk: Systematic error in prospective studies. Addict Res Theory. Informa UK Ltd UK; 2006 Jan 20;14(2):101–32.

46. Roerecke M, Rehm J. Irregular heavy drinking occasions and risk of ischemic heart disease: a systematic review and meta-analysis. Am J Epidemiol. 2010 Mar 15;171(6):633–44.

47. Shield K, Parry CDH, Rehm J. Focus on: Chronic diseases and conditions related to alcohol use. Alcohol Res Curr Rev. 2014;35(2):155–73.

48. Hill-McManus D, Angus C, Meng Y, Holmes J, Brennan A, Sylvia Meier P. Estimation of usual occasion-based individual drinking patterns using diary survey data. Drug Alcohol Depend. 2014 Jan;134:136–43.

49. Hill-McManus D, Angus C, Meng Y, Holmes J, Brennan A, Meier P. Injury alcohol-attributable fractions: methodological issues and developments. Sheffield; 2014;

50. Holmes J, Meier PS, Booth A, Guo Y, Brennan A. The temporal relationship between per capita alcohol consumption and harm: a systematic review of time lag specifications in aggregate time series analyses. Drug Alcohol Depend. 2012 Jun 1;123(1–3):7–14.

51. Jones L, Bellis M. Updating England-specific alcohol-attributable fractions. Liverpool; 2013.

52. Siegler V, Al-Hamad A, B J, C W, Sheron N. Social inequalities in alcohol-related adult mortality by National Statistics Socio-economic Classifications, England and Wales 2001-03. Heal Stat Q. 2011;50.

53. Public Health England. Response to consultation on alcohol indicator published [Internet]. 2013. Available from: https://www.gov.uk/government/news/response-to-consultation-on-alcohol-indicator-published

54. Perkins C, Hennessey M. Understanding alcohol-related hospital admissions. 2014.

55. Probst C, Roerecke M, Behrendt S, Rehm J. Socioeconomic differences in alcohol-attributable mortality compared with all-cause mortality: a systematic review and meta-analysis. Int J Epidemiol. 2014 Aug 1;43(4):1314–27.

56. Mackenbach JP, Kulhánová I, Bopp M, Borrell C, Deboosere P, Kovács K, et al. Inequalities in Alcohol-Related Mortality in 17 European Countries: A Retrospective Analysis of Mortality Registers. PLoS Med. Public Library of Science; 2015 Dec 1;12(12):e1001909.

57. Bellis MA, Hughes K, Nicholls J, Sheron N, Gilmore I, Jones L. The alcohol harm paradox: using a national survey to explore how alcohol may disproportionately impact health in deprived individuals. BMC Public Health. BioMed Central; 2016 Jan 18;16(1):111.

58. Lewer D, Meier P, Beard E, Boniface S, Kaner E, Rehm J, et al. Unravelling the alcohol harm paradox: a population-based study of social gradients across very heavy drinking thresholds. BMC Public Health. BioMed Central; 2016 Dec 19;16(1):599.

59. Beard E, Brown J, West R, Angus C, Brennan A, Holmes J, et al. Deconstructing the Alcohol Harm Paradox: A population based survey of adults in England. Ciccozzi M, editor. PLoS One. 2016 Sep 28;11(9):e0160666.

60. Curtis L. Unit costs of health and social care 2014. Canterbury; 2014.

61. Cardiff Research Consortium. Health Outcomes Data Repository. 2011.

62. Office for National Statistics. Crime in England and Wales, year ending September 2012. 2013.

63. Home Office. Integrated Offender Management efficiency toolkit phase 2: revised unit costs of crime and multipliers. 2011.

64. Office for National Statistics. Offending Crime and Justice Survey 2005. 2008.

65. Office for National Statistics. Quarterly Labour Force Survey 2007-2012.

66. Roche AM, Pidd K, Berry JG, Harrison JE. Workers' drinking patterns: the impact on absenteeism in the Australian work-place. Addiction. 2008 May;103(5):738–48.

67. Vandenberg B, Sharma A, Ashton T, Casswell S, Gilmore L, Ataguba J, et al. Are Alcohol Taxation and Pricing Policies Regressive? Product-Level Effects of a Specific Tax and a Minimum Unit Price for Alcohol. Alcohol Alcohol. The Oxford University Press; 2016 Jul;51(4):493–502.

68. OECD. Tackling Harmful Alcohol Use: Economics and Public Health Policy. Sassi F, editor. OECD Publishing; 2015.

69. Angus C, Latimer N, Preston L, Li J, Purshouse R. What are the Implications for Policy Makers? A Systematic Review of the Cost-Effectiveness of Screening and Brief Interventions for Alcohol Misuse in Primary Care. Front psychiatry. 2014 Jan;5:114.

70. Scottish Public Health Observatory. Informing investment to reduce inequalities: a commentary. Edinburgh; 2014.

71. Mackenbach JP, Kunst AE. Measuring the magnitude of socio-economic inequalities in health: An overview of available measures illustrated with two examples from Europe. Soc Sci Med. 1997 Mar;44(6):757–71.

72. Keurhorst MN, Anderson P, Spak F, Bendtsen P, Segura L, Colom J, et al. Implementing

training and support, financial reimbursement, and referral to an internet-based brief advice program to improve the early identification of hazardous and harmful alcohol consumption in primary care (ODHIN): study protocol for a cluster rando. Implement Sci. 2013 Jan;8:11.

73. Cherpitel CJ. Drinking patterns and problems among primary care patients: a comparison with the general population. Alcohol Alcohol. 1991 Jan 1;26(5–6):627–33.

74. O'Donnell A, Anderson P, Newbury-Birch D, Schulte B, Schmidt C, Reimer J, et al. The impact of brief alcohol interventions in primary healthcare: a systematic review of reviews. Alcohol Alcohol. 2013 Nov 13;49(1):66–78.

75. Fekjaer HO. Alcohol-a universal preventive agent? A critical analysis. Addiction. 2013 Dec;108(12):2051–7.

76. Hoch JS, Briggs AH, Willan AR. Something old, something new, something borrowed, something blue: a framework for the marriage of health econometrics and cost-effectiveness analysis. Health Econ. 2002 Jul;11(5):415–30.