Increases in taxation to reduce population drinking levels

Matrix Insight, in collaboration with Imperial College London, Kings College London and Bazian Ltd, were commissioned by Health England to undertake a research study to develop and apply a method for prioritising investments in preventative interventions for England. Seventeen preventative health interventions were included in the study. Each intervention was evaluated in terms of the following criteria: reach; inequality score; cost-effectiveness; and affordability. This report presents the results of the analysis for one of the interventions: increases in taxation to reduce population smoking rates. The full report of the study is available from the ***H.E.L.P.*** website.

Summary

Description of the intervention
A 5% increase in alcohol tax.

Criteria	Measure	Value	Certainty
1. Reach			
Percentage of population affected by the condition and that could potentially benefit from the intervention.	Adults drinking above threshold limits as a percentage of the population aged 15 and above in England (LJMU, 2008)	18.44%	★★★
2. Inequality score			
Ratio of the percentage of disadvantaged population to the percentage of the general population that could potentially benefit from the intervention.	Ratio of the percentage of heavy drinkers in skilled manual and part/non-skilled manual occupations to heavy drinkers in the general population (Batty et al, 2008)	1.78	★
3. Cost-effectiveness			
Cost of the intervention per QALY gained (in £2007/08)	See cost-effectiveness	£0	★★
Net cost of the intervention per QALY gained (in £2007/08)	See cost-effectiveness	-£5,267	★★
Timing of benefits	QALY gain and cost savings are estimated to occur in the long-run (5 years or more after the intervention).		
4. Affordability			
Total cost of implementing the intervention at the national level	Multiple of eligible individuals and unit cost of the intervention	Less than £100 million	★★

Key to certainty grading scales

★ Low quality evidence

★★ Medium quality evidence

★★★ High quality evidence

Box 1. Cost per QALY gained

A quality adjusted life year (QALY) is a simple way of combining quality of life with length of life.
One QALY is equivalent to one year in full health. The cost per QALY gained is therefore the cost of achieving one extra year of full health. Its calculation is based on the following formula:

$$cost\ per\ QALY\ gained = \frac{incremental\ cost\ of\ intervention}{QALYs\ gained}$$

The net cost per QALY gained is the cost per QALY considering the incremental cost of the intervention as well as the cost saved through health treatment avoided. Its calculation is based on the following formula:

$$net\ cost\ per\ QALY\ gained = \frac{incremental\ cost\ of\ intervention - cost\ savings}{QALYs\ gained}$$

Cost effectiveness

Cost. A 5% increase in alcohol tax is assumed to have no cost from a societal point of view. This assumption is based on the fact that the average administrative cost of taxes is very low (less than 1% of revenue, Shaw et al, 2008) and that the marginal administrative cost associated with a cigarette tax increase is likely to be negligible.

Effect. Compared to current tax level a 5% alcohol tax increment reduces the level of alcohol consumption by 2.2% per cent. This effect was obtained from a review undertaken to identify evidence on the effectiveness and cost-effectiveness of interventions to reduce alcohol consumption.

Benefits. The benefits of the intervention derive from stopping individuals smoking. Two types of benefits are considered: QALYs and health care cost savings. Based on the QALYs gained and the health care cost savings of reduced alcohol consumption, a 2.2 per cent increase in the level of drinking is associated with the following benefits:

- An additional 0.001 QALYs per person
- Cost savings of £4.18 per person (£2007/08)

Please refer to decision model for details on how the QALY gain and cost savings were calculated.

Decision model

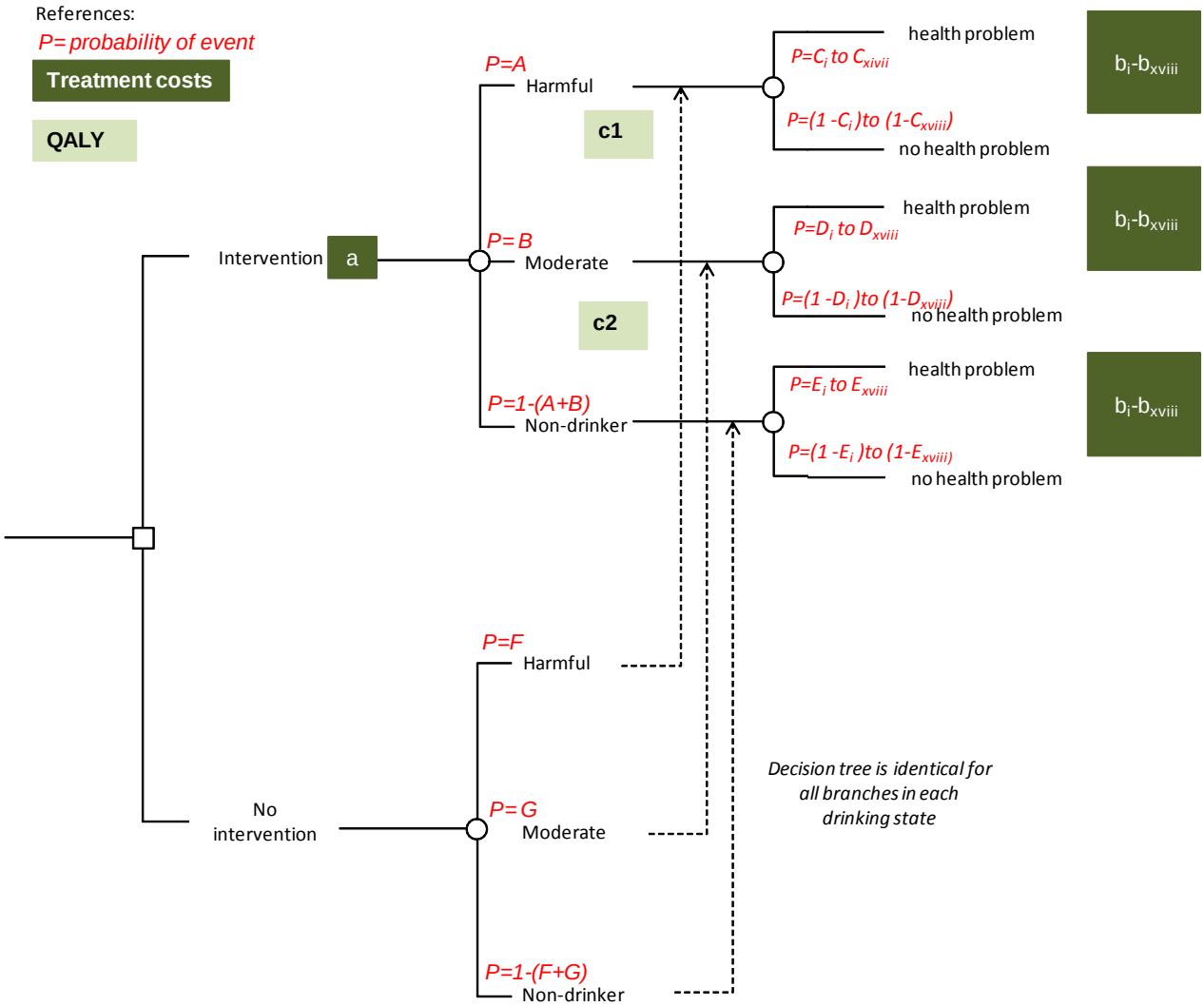
An dynamic model was built to estimate the cost-effectiveness of the intervention. The model estimates the QALY gain and cost savings associated with the intervention. Figure 1 illustrates the structure of the model, which is based on the following assumptions:

- The effect of the intervention is given by a change in the chances of an individual's reducing drinking.
- Individuals receiving the intervention are assumed to be 45 years old.
- Drinking is assumed to be associated with eighteen diseases. These diseases have impacts in terms of quality of life and health care costs.

    - Malignant neoplast of lip, oral cavity and pharynx
    - Malignant neoplast of oesophagus
    - Malignant neoplast of colon
    - Malignant neoplast of rectum
    - Malignant neoplast of liver and bile
    - Malignant neoplast of larynx
    - Malignant neoplast of breast
    - Diabetes mellitus (Type II)
    - Epilepsy and status epilepticus
    - Hypertensive diseases
    - Ischaemic Heart Disease
    - Cardiac arrhythmias
    - Haemorrhagic stroke
    - Ischaemic stroke
    - Oesophageal varices
    - Unspecified liver disease
    - Cholelithiasis
    - Psoriasis

- The probabilities of experiencing these diseases vary for heavy drinkers, moderate drinkers and non-drinkers. Those drinking less generally have reduced probabilities of experiencing the diseases. Thus, reducing drinking reduces the probability of experiencing these diseases and produces corresponding improvements in quality of life and health care cost savings.

Figure 1. Alcohol consumption model



The model draws the following estimates from the literature:

- The unit cost of the intervention (Table 1).
- The effect of the intervention on people's smoking behaviour (Table 1).
- The probabilities that those who smoke experience diseases (Table 2)
- The probabilities that those who don't smoke experience diseases (Table 2).
- The impact of experiencing diseases on quality of life, measured in QALYs (Table 3).
- The impact of experiencing diseases on health care treatment costs (Table 3).

Table 1. Intervention costs and effects (monetary values in £2007/08)

Ref	Description	Value	Calculation and source
a	Cost of intervention	£0	This assumption is based on the fact that the average administrative cost of taxes is very low (always less than 1% of revenue, Shaw et al, 2008, p.27) and that the marginal administrative cost associated with a cigarette tax increase is likely to be negligible.
A	P(if intervention, heavy drinker)	18.4%	This is the percentage of individuals that are heavy drinkers following the intervention. Assumes the reduction in drinking is a uniform reduction across all levels of drinking. See evidence review.
B	P(if intervention, moderate drinker)	58.2%	Applying the same effect and assumptions for moderate drinkers as for heavy drinkers.
F	P(if no intervention, heavy drinker)	18.2%	Current levels of heavy drinkers. Defined as 40mg/day or more for males and 19mg/day or more for females.
G	P(if no intervention, moderate drinker)	58.0%	Current level of moderate drinkers. Defined as 1-39mg/day for males and 1-18mg/day for females.

Table 2. Transition probabilities

<table>
<tr><th>Ref</th><th>Description</th><th>Value</th><th>Calculation and source</th></tr>
<tr><td colspan="4">The probability of contracting the disease for non-drinkers was assumed to be equivalent to the average prevalence of the disease among heavy drinkers. To obtain these, the following formula was applied:
$$D = \frac{x}{t} \cdot D_x \cdot RR_x + \frac{y}{t} \cdot D_x \cdot RR_y + \frac{z}{t} \cdot D_x \cdot RR_z$$
where: D = prevalence of disease; RR = relative risk of contracting the disease; x = non-drinkers; y = moderate drinkers; z = heavy drinkers.; and t = total population.</td></tr>
<tr><td>C_i</td><td>P(if heavy drinker, Malignant neoplast of lip, oral cavity and pharynx)</td><td>0.041%</td><td rowspan="3">These were obtained by applying the following parameters to the formula set out at the beginning of the table:
Prevalence of the disease in the total population aged 55 to 64 years old (D=0.021%). Cancer Research UK statistics.
Relative risk (RR heavy drinkers =3.3; RR moderate drinkers=1.5; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.43, Males20-39g/day = 1.86, Males40-74g/day = 3.11, Males75+g/day = 6.45, 0g/day = 1, Females1-19g/day = 1.43, Females20-39g/day = 1.86, Females40-74g/day = 3.11, Females75+g/day = 6.45). Based on RR from University of Sheffield (2008).</td></tr>
<tr><td>D_i</td><td>P(if moderate drinker, Malignant neoplast of lip, oral cavity and pharynx)</td><td>0.019%</td></tr>
<tr><td>E_i</td><td>P(if non-drinker, Malignant neoplast of lip, oral cavity and pharynx)</td><td>0.012%</td></tr>
</table>

Ref	Description	Value	Calculation and source
C_{ii}	P(if heavy drinker, Malignant neoplast of oesophagus)	0.040%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.026%). Cancer Research UK statistics. ▪ Relative risk (RR heavy drinkers =2.05; RR moderate drinkers=1.23; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.20, Males40-74g/day = 1.93, Males75+g/day = 3.59, 0g/day = 1, Females1-19g/day = 1.20, Females20-39g/day = 1.39, Females40-74g/day = 1.93, Females75+g/day = 3.59). Based on RR from University of Sheffield (2008).
D_{ii}	P(if moderate drinker , Malignant neoplast of oesophagus)	0.024%	
E_{ii}	P(if non-drinker, Malignant neoplast of oesophagus)	0.020%	
C_{iii}	P(if heavy drinker, Malignant neoplast of colon)	0.068%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the total population aged 55 to 64 years old (D=0.064%). Cancer Research UK statistics ▪ Relative risk (RR heavy drinkers =1.10; RR moderate drinkers=1.03; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.03, Males40-74g/day = 1.10, Males75+g/day = 1.21, 0g/day = 1, Females1-19g/day = 1.03, Females20-39g/day = 1.05, Females40-74g/day = 1.10, Females75+g/day = 1.21). Based on RR from University of Sheffield (2008).
D_{iii}	P(if moderate drinker, Malignant neoplast of colon)	0.064%	
E_{iii}	P(if non-drinker, Malignant neoplast of colon)	0.062%	
C_{iv}	P(if heavy drinker, Malignant neoplast of rectum)	0.054%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.048%). Cancer Research UK statistics. ▪ Relative risk (RR heavy drinkers =1.20; RR moderate drinkers=1.06; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.05, Males40-74g/day = 1.19, Males75+g/day = 1.42, 0g/day = 1, Females1-19g/day = 1.05, Females20-39g/day = 1.09, Females40-74g/day = 1.19, Females75+g/day = 1.42). Based on RR from University of Sheffield (2008).
D_{iv}	P(if moderate drinker, Malignant neoplast of rectum)	0.047%	
E_{iv}	P(if non-drinker, Malignant neoplast of rectum)	0.045%	
C_{iv}	P(if heavy drinker, Malignant neoplast of liver and bile)	0.011%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.009%). Cancer Research UK statistics.

Ref	Description	Value	Calculation and source
D_{iv}	P(if moderate drinker, Malignant neoplast of liver and bile)	0.009%	▪ Relative risk (RR heavy drinkers =1.40; RR moderate drinkers=1.11; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.10, Males40-74g/day = 1.4, Males75+g/day = 1.81, 0g/day = 1, Females1-19g/day = 1.10, Females20-39g/day = 1.19, Females40-74g/day = 1.4, Females75+g/day = 1.81). Based on RR from University of Sheffield (2008).
E_{iv}	P(if non-drinker, Malignant neoplast of liver and bile)	0.008%	
C_{vi}	P(if heavy drinker, Malignant neoplast of larynx)	0.016%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.010%). Cancer Research UK statistics. ▪ Relative risk (RR heavy drinkers =2.16; RR moderate drinkers=1.25; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.22, Males40-74g/day = 2.02, Males75+g/day = 3.86, 0g/day = 1, Females1-19g/day = 1.22, Females20-39g/day = 1.43, Females40-74g/day = 2.02, Females75+g/day = 3.86). Based on RR from University of Sheffield (2008).
D_{vi}	P(if moderate drinker, Malignant neoplast of larynx)	0.009%	
E_{vi}	P(if non-drinker, Malignant neoplast of larynx)	0.007%	
C_{vii}	P(if heavy drinker, Malignant neoplast of breast)	0.212%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.195%). Cancer Research UK statistics. ▪ Relative risk (RR heavy drinkers =1.13; RR moderate drinkers=1.03; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1, Males40-74g/day = 1, Males75+g/day = 1, 0g/day = 1, Females1-19g/day = 1.07, Females20-39g/day = 1.21, Females40-74g/day = 1.35, Females75+g/day = 1.46). Based on RR from University of Sheffield, (2008) although where no data existed (for males) a value of 1 was assumed.
D_{vii}	P(if moderate drinker, Malignant neoplast of breast)	0.193%	
E_{vii}	P(if non-drinker, Malignant neoplast of breast)	0.187%	
C_{viii}	P(if heavy drinker, Diabetes mellitus (Type II))	0.542%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.582%) Incidence based on US data from http://www.wrongdiagnosis.com/d/diabetes/incidence-types.htm and applied to UK population.

Ref	Description	Value	Calculation and source
D_{viii}	P(if moderate drinker, Diabetes mellitus (Type II))	0.571%	▪ Relative risk (RR heavy drinkers =0.84; RR moderate drinkers=0.89; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 0.99, Males40-74g/day = 0.73, Males75+g/day = 0.73, 0g/day = 1, Females1-19g/day = 0.92, Females20-39g/day = 0.87, Females40-74g/day = 1.13, Females75+g/day = 1.13). Based on RR from University of Sheffield (2008) with the exception of those drinking over 75 g/day. Data was not available and therefore RR was assumed to be the same as those drinking 40-74 g/day.
E_{viii}	P(if non-drinker, Diabetes mellitus (Type II))	0.642%	
C_{ix}	P(if heavy drinker, Epilepsy and status epilepticus)	0.180%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.073%). Data from NICE - Commissioning Guidelines. "Assumptions used in estimating a population benchmark". http://www.nice.org.uk/usingguidance/commissioningguides/epilepsiesinadults/determininglocalservicelevels/AssumptionsPopulationBenchmark.jsp ▪ Relative risk (RR heavy drinkers =7.08; RR moderate drinkers=2.33; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.23, Males40-74g/day = 6.83, Males75+g/day = 6.83, 0g/day = 1, Females1-19g/day = 1.34, Females20-39g/day = 7.22, Females40-74g/day = 7.52, Females75+g/day = 7.52). Based on RR from University of Sheffield (2008), with the exception of those drinking over 75 g/day. Data was not available and therefore RR was assumed to be the same as those drinking 40-74g/day.
D_{ix}	P(if moderate drinker, Epilepsy and status epilepticus)	0.059%	
E_{ix}	P(if non-drinker, Epilepsy and status epilepticus)	0.025%	
C_{x}	P(if heavy drinker, Hypertensive diseases)	3.489%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=2.102%). Based on number of hospital admissions from University of Sheffield (2008). ▪ Relative risk (RR heavy drinkers =2.22; RR moderate drinkers=1.20; RR non-drinkers=1). RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.15, Males40-74g/day = 2.04, Males75+g/day = 4.15, 0g/day = 1, Females1-19g/day = 1.15, Females20-39g/day = 1.43, Females40-74g/day = 2.04, Females75+g/day = 4.15). Based on RR from University of Sheffield (2008).
D_{x}	P(if moderate drinker, Hypertensive diseases)	1.877%	
E_{x}	P(if non-drinker, Hypertensive diseases)	1.569%	

Ref	Description	Value	Calculation and source
C_{xi}	P(if heavy drinker, Ischaemic Heart Disease)	17.186%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=14.622%). Incidence based on US data from http://www.wrongdiagnosis.com/i/ischemic_heart_disease/prevalence.htm and applied to UK population. ▪ Relative risk (RR heavy drinkers =1.08; RR moderate drinkers=0.84; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 0.82, Males40-74g/day = 0.98, Males75+g/day = 1.53, 0g/day = 1, Females1-19g/day = 0.85, Females20-39g/day = 0.90, Females40-74g/day = 1.10, Females75+g/day = 1.87). Based on RR from University of Sheffield (2008).
D_{xi}	P(if moderate drinker, Ischaemic Heart Disease)	13.304%	
E_{xi}	P(if non-drinker, Ischaemic Heart Disease)	15.862%	
C_{xii}	P(if heavy drinker, Cardiac arrhythmias)	8.533%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=5.827%). Incidence based on US data from http://www.wrongdiagnosis.com/a/arrhythmias/prevalence.htm and applied to UK population. ▪ Relative risk (RR heavy drinkers =2.23; RR moderate drinkers=1.51; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.51, Males40-74g/day = 2.23, Males75+g/day = 2.23, 0g/day = 1, Females1-19g/day = 1.51, Females20-39g/day = 2.23, Females40-74g/day = 2.23, Females75+g/day = 2.23). Based on RR from University of Sheffield (2008), with the exception of those drinking over 75 g/day. Data was not available and therefore RR was assumed to be the same as those drinking 40-74 g/day.
D_{xii}	P(if moderate drinker, Cardiac arrhythmias)	5.778%	
E_{xii}	P(if non-drinker, Cardiac arrhythmias)	3.827%	
C_{xiii}	P(if heavy drinker, Haemorrhagic stroke)	0.316%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.188%). Ninewells Hospital and Medical School ▪ Relative risk (RR heavy drinkers =2.14; RR moderate drinkers=1.11; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level (Males1-19g/day = 1.10, Males40-74g/day = 1.82, Males75+g/day = 4.7, 0g/day = 1, Females1-19g/day = 1.10, Females20-39g/day = 1.19, Females40-74g/day = 1.82, Females75+g/day = 4.7). Based on RR from University of Sheffield (2008).
D_{xiii}	P(if moderate drinker, Haemorrhagic stroke)	0.164%	
E_{xiii}	P(if non-drinker, Haemorrhagic stroke)	0.147%	

Ref	Description	Value	Calculation and source
C_{xiv}	P(if heavy drinker, Ischaemic stroke)	0.171%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.106%). Ninewells Hospital and Medical School ▪ Relative risk (RR heavy drinkers =1.68; RR moderate drinkers=0.86; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 0.85, Males40-74g/day = 1.17, Males75+g/day = 4.37, 0g/day = 1, Females1-19g/day = 0.85, Females20-39g/day = 0.9, Females40-74g/day = 1.17, Females75+g/day = 4.37). Based on RR from University of Sheffield (2008).
D_{xiv}	P(if moderate drinker, Ischaemic stroke)	0.088%	
E_{xiv}	P(if non-drinker, Ischaemic stroke)	0.102%	
C_{xv}	P(if heavy drinker, Oesophageal varices)	0.034%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.012%). Based on hospital admissions from University of Sheffield (2008). ▪ Relative risk (RR heavy drinkers =9.30; RR moderate drinkers=2.11; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.95, Males40-74g/day = 7.13, Males75+g/day = 26.53, 0g/day = 1, Females1-19g/day = 1.95, Females20-39g/day = 2.9, Females40-74g/day = 7.13, Females75+g/day = 26.53). Based on RR from University of Sheffield (2008).
D_{xv}	P(if moderate drinker, Oesophageal varices)	0.008%	
E_{xv}	P(if non-drinker, Oesophageal varices)	0.004%	
C_{xvi}	P(if heavy drinker, Unspecified liver disease)	0.982%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.335%). Incidence based on US data from http://www.wrongdiagnosis.com/c/cirrhosis_of_the_liver/prevalence.htm ▪ Relative risk (RR heavy drinkers =9.30; RR moderate drinkers=2.11; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.95, Males40-74g/day = 7.13, Males75+g/day = 26.53, 0g/day = 1, Females1-19g/day = 1.95, Females20-39g/day = 2.9, Females40-74g/day = 7.13, Females75+g/day = 26.53). Based on RR from University of Sheffield (2008).
D_{xvi}	P(if moderate drinker, Unspecified liver disease)	0.222%	
E_{xvi}	P(if non-drinker, Unspecified liver disease)	0.106%	

Ref	Description	Value	Calculation and source
C_{xvii}	P(if heavy drinker, Cholelithiasis)	0.171%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=0.244%). Based on hospital admissions from University of Sheffield (2008). ▪ Relative risk (RR heavy drinkers =0.56; RR moderate drinkers=0.80; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 0.82, Males40-74g/day = 0.5, Males75+g/day = 0.5, 0g/day = 1, Females1-19g/day = 0.82, Females20-39g/day = 0.68, Females40-74g/day = 0.5, Females75+g/day = 0.5). Based on RR from University of Sheffield (2008) with the exception of those drinking over 75 g/day. Data was not available and therefore RR was assumed to be the same as those drinking 40-74 g/day.
D_{xvii}	P(if moderate drinker, Cholelithiasis)	0.242%	
E_{xvii}	P(if non-drinker, Cholelithiasis)	0.304%	
C_{xviii}	P(if heavy drinker, Psoriasis)	4.959%	These were obtained by applying the following parameters to the formula set out at the beginning of this table: ▪ Prevalence of the disease in the population aged 55 – 64 years old (D=3.789%). Incidence based on US data from http://www.wrongdiagnosis.com/p/psoriasis/prevalence.htm ▪ Relative risk (RR heavy drinkers =1.99; RR moderate drinkers=1.58; RR non-drinkers=1) RR calculations have been based on weighted average RR scores based on different population with each drinking level. (Males1-19g/day = 1.58, Males40-74g/day = 2.2, Males75+g/day = 2.2, 0g/day = 1, Females1-19g/day = 1.58, Females20-39g/day = 1.6, Females40-74g/day = 2.2, Females75+g/day = 2.2) Based on RR from University of Sheffield (2008) with the exception of those drinking over 75 g/day. Data was not available and therefore RR was assumed to be the same as those drinking 40-74 g/day.
D_{xviii}	P(if moderate drinker, Psoriasis)	3.944%	
E_{xviii}	P(if non-drinker, Psoriasis)	2.491%	

Table 3. Associated outcomes (monetary values in £2007/08)

Ref	Outcome	Value	Calculation and source
All lifetime treatment cost calculations were based on the present value of the annual treatment cost through the expected duration of the disease. The duration of the disease was assumed to be given by the difference between the average onset and mortality ages for the disease. The onset age of the disease was assumed 55 years old. Total treatment costs were discounted to the age of individuals receiving the intervention, which was assumed 45 years old, at a 3.5% annual rate.			

Ref	Outcome	Value	Calculation and source
b_i	Malignant neoplast of lip, oral cavity and pharynx costs	£20,573	The annual treatment of head and neck cancer cost was £12,325. This is based on NICE Guidance on Cancer services and the number of annual cases. The mortality age is assumed to be equal for all head and neck cancer and an average mortality of 64.6, as reported by Jay F. Piccirillo and Irene Costas.
b_{ii}	Malignant neoplast of oesophagus cost	£20,573	The annual treatment of head and neck cancer cost was £12,325. This is based on N ICE Guidance on Cancer services and the number of annual cases. The mortality age is assumed to be equal for all head and neck cances and an average mortality of 64.6, as reported by Jay F. Piccirillo and Irene Costas.
b_{iii}	Malignant neoplast of colon cost	N/A	Data on costs was not available and the treatment cost savings have been excluded from the modelling.
b_{iv}	Malignant neoplast of rectum cost	N/A	Data on costs was not available and the treatment cost savings have been excluded from the modelling.
b_v	Malignant neoplast of liver and bile cost	N/A	Data on costs was not available and the treatment cost savings have been excluded from the modelling.
b_{vi}	Malignant neoplast of larynx cost	£20,573	The annual treatment of head and neck cancer cost was £12,325. This is based on N ICE Guidance on Cancer services and the number of annual cases. The mortality age is assumed to be equal for all head and neck cances and an average mortality of 64.6, as reported by Jay F. Piccirillo and Irene Costas.
b_{vi}	Malignant neoplast of breast cost	£16,859	The annual treatment cost was estimated using Programme Budget data for 2006/07 was £2,381. The average mortality age is 67.5, based on a report from the Association of Occupation and Breast Cancer Mortality in the State of Vermont.
b_{vii}	Diabetes mellitus (Type II) cost	£36,622	The annual treatment cost is estimated as £3,213 and the average mortality age is 79.05, as reported by Matrix (2006).
b_{viii}	Epilepsy and status epilepticus cost	£46,250	The annual treatment cost is estimated as £3,989 based on Gay Frankenfield, RN, WebMD Health News (2000), and the average mortality age is 79.7. This was assumed to be the same as the national average age of mortality for people currently 45.
b_{ix}	Hypertensive diseases cost	£16,639	The annual treatment cost was estimated by University of York (2007) at £1511 (in £2007/08) based on data provided by the British Heart Foundation (2003). The average mortality age is 77.3 for men and 79.3 for women, as reported by Matrix (2006).

Ref	Outcome	Value	Calculation and source
b_x	Ischaemic Heart Disease cost	£16,639	The annual treatment cost was estimated by Matrix (2006) at £1,511 (in £2007/08) based on data from the British Heart Foundation. The average mortality was assumed to increase with the onset age of the disease. The average mortality age is 77.3 for men and 79.3 for women, as reported by Matrix (2006).).
b_{xi}	Cardiac arrhythmias cost	£16,639	The annual treatment cost was estimated by Matrix (2006) at £1,511 (in £2007/08) based on data from the British Heart Foundation. The average mortality was assumed to increase with the onset age of the disease. The average mortality age is 77.3 for men and 79.3 for women, as reported by Matrix (2006).).
b_{xii}	Haemorrhagic stroke cost	£20,017	The annual treatment cost was estimated by Matrix (2006) at £2,194 (in £2007/08) based on data from the Department of Health. The average mortality age is 72.4 for both men and women, as reported by Matrix (2006).
b_{xiii}	Ischaemic stroke cost	£20,017	The annual treatment cost was estimated by Matrix (2006) at £2,194 (in £2007/08) based on data from the Department of Health. The average mortality age is 72.4 for both men and women, as reported by Matrix (2006).
b_{xiv}	Oesophageal varices cost	NA	Data on costs was not available and the treatment cost savings have been excluded from the modelling.
b_{xv}	Unspecified liver disease cost	NA	Data on costs was not available and the treatment cost savings have been excluded from the modelling.
b_{xvi}	Heart failure cost	£16,639	The annual treatment cost was estimated by Matrix (2006) at £1,511 (in £2007/08) based on data from the British Heart Foundation. The average mortality was assumed to increase with the onset age of the disease. The average mortality age is 77.3 for men and 79.3 for women, as reported by Matrix (2006).).
b_{xvii}	Cholelithiasis cost	NA	Data on costs was not available and the treatment cost savings have been excluded from the modelling.
b_{xviii}	Psoriasis cost	£17,159	The annual treatment cost is £1,480 as reported by Marchetti A (2005) in the NHS Economic Evaluation Database, and converted into sterling based on a conversion of $0.6059 to £1. The average mortality age is79.7, ie individual's mortality is the same as the national profile.
C1 & C2	QALYs: reduced alcohol consumption	0.32 0.02	The QALYs for reduced alcohol consumption are shown for heavy drinkers becoming moderate drinkers. These are calculated based on utility data from University Sheffield (2008).

Effectiveness evidence

A literature review was undertaken by Bazian to identify evidence on the effectiveness and cost-effectiveness of increases in taxation to reduce population smoking rates. Further details are available on the evidence methods page of the ***H.E.L.P.*** website.

The review of the evidence on the effectiveness of increases in taxation to reduce population smoking rates identified three reviews of studies. Table 4 provides the following details of the studies identified:

- Population
- Intervention
- Results

Table 5 provides a quality assessment of the effectiveness and cost-effectiveness studies. Further details are available on the quality appraisal methods page.

The following criteria were applied to select effectiveness evidence for undertaking the economic analysis:

- Location. Studies from the UK were preferred over studies from other locations.
- Population. Studies applied to the general population were preferred over studies applied to restricted population groups (e.g. pregnant women; individuals from specific communities/nationalities).
- Counterfactual. Studies for which the counterfactual intervention was ‘usual care’ or ‘do nothing’ in a UK setting were preferred over studies for which the counterfactual was different from ‘usual care’ or ‘do nothing’.
- Method. Studies using more rigorous design methods (e.g. randomised control trials or quasi experimental designs with regression models controlling for confounders) were preferred over studies using less rigorous design methods (e.g. before-after studies or simple correlation analysis).

Table 4. Effectiveness of taxation to reduce alcohol consumption

Study reference	Population	Intervention	Results
Information on effects of alcohol prices on consumption is discussed by Babor et al, 2003 who quotes several price elasticity estimates from a variety of sources. There is insufficient information given to determine the quality of the underlying models of demand.			
Osterberg, 1995 ▪ for pragmatic reasons, the original source (a text book) of these effect sizes has not been retrieved	Unclear	Unclear	▪ US: estimated values of price elasticity: ▪ Beer: 0 to -1.4 ▪ Wine: -0.4 to -1.8 ▪ Distilled spirits: -0.1 to -2.0
Godfrey, 1989 ▪ narrative review of use of dynamic models in assessing factors influencing the consumption of alcohol and tobacco	Unclear	Unclear	Price elasticities from various studies discussed: ▪ Atkinson & Skegg (1973): 0.00 for men, -0.35 for women ▪ McGuinness and Cowling (1975): -0.99 short run, -1.05 long run ▪ Radfar (1985): -0.23 short run, -0.39 long run ▪ Godfrey and Maynard (1988): -0.56
Grossman, 1998 ▪ econometric study	Sample of between 15,000 and 19,000 high school seniors surveyed from a nationally representative sample about illegal drugs, alcohol and cigarettes. 2,400 selected respondents were chosen for follow-up starting in 1976 (those reporting marijuana on 20 or more occasions in the past 30 days or use of other illegal drug at least once in the past 30 days were selected with a higher probability). Alcohol demand functions were estimated from panels formed from	Alcohol demand models using an annual measure of consumption from survey of high school seniors. Current annual price of alcohol was computed as a simple average of the prices over four quarters (first two quarters of the year in which the survey was conducted and the last two quarters of the previous year). Current past and future prices are annual averages of quarterly prices rather than prices as of a certain month in a year (so therefore account fully for state excise tax	Price elasticity of demand from a demand function for the number of drinks of alcohol in the past year that ignores addictive behaviour: -0.29 (average result from two regression models: first estimate 'may be influenced by omitted variables bias, while the second may be influenced by simultaneous equations bias) Price elasticity of demand from a model that includes addiction: long-run price

Study reference	Population	Intervention	Results
	the high school senior surveys conducted from 1976 through 1985: between one and five observations on each person. 21,420 observations (person-follow-ups) from 10 of the 20 survey cohorts included in the final analysis – i.e. average of three observations per 7,140 respondents. Number of drinks of alcohol regressed on a variety of independent variables including gender, race, age, annual earnings, education, work status, student status, religion, marital status and number of children	changes that occur during the 12-month period for which consumption is measured) Consumption data on specific types of alcoholic beverage (wine, beer, spirits) are not collected so the price of beer is used as a measure of the price of alcohol (specific price used is the price of a six-pack of Budweiser or Schlitz)	elasticity: -0.386; short-run price elasticity: -0.225

Table 5. Quality assessment for econometric studies

Study reference	QA for economic studies				Score	Grading (++ 4-6; + 3; -0-2)
	Reports statistical assumptions?	Adequate sample size?	Strategies to minimise bias & conf?	Unambiguous direction of causality? (studies conducted at one time point)		
Grossman, 1998	Yes	Don't know	Yes	Yes	3	++

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