Optimizing Delivery of Health Care Interventions (ODHIN)

Cost-Effectiveness - Model Report

Deliverable D3.1, Work Package 3

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List of Abbreviations

AAF	Alcohol-Attributable Fraction
BIC	Bayesian Information Criterion
CBS	Central Bureau of Statistics (Netherlands)
DHD	Dutch Hospital Data Foundation
EU	European Union
GP	General Practitioner
GUS	Central Statistical Office (Poland)
ICER	Incremental Cost Effectiveness Ratio
ISTAT	Italian National Statistics Institute
NFZ	National Health Fund (Poland)
NHG	Dutch College of General Practitioners
OLS	Ordinary Least Squares
PHEPA	Primary Health Care European Project on Alcohol
POLS	Survey of Living Conditions (Netherlands)
QALY	Quality-Adjusted Life Year
SAPM	Sheffield Alcohol Policy Model
SARG	Sheffield Alcohol Research Group
SBI	Screening and Brief Interventions
WP	Work Package

1. Objectives

The main objectives of ODHIN's Work Package 3 were:

1) To adapt the Sheffield Alcohol Policy Model and its appraisal of the cost-effectiveness of screening and brief interventions from its current England context, to model the effectiveness of screening and brief interventions in the Netherlands, Poland and Italy
2) To use the results of the modelling to consider generalizability of interventions across the EU
3) Investigate modelling long-term cost-effectiveness of dissemination approaches studies in RCTs in other WPs

Sections 2-6 of this report present the work relating to objective 1. Section 7 presents the work relating to objective 2. As the results of the WP5 RCT will not be available until approximately month 39, the work relating to objective 3 will be presented in a subsequent addendum to this report. **A summary of the key findings of this WP can be found in Section 8.**

2. Introduction to the modelling

2.1 Overview of the Sheffield model

The Sheffield Alcohol Policy Model (SAPM) was developed by the Sheffield Alcohol Research Group (SARG) as part of work commissioned by the UK Department of Health (Brennan et al. 2008) and NICE (Purshouse et al. 2009) in order to model the impact on population health and health resource use of a range of potential government policies on alcohol. Policies which have been evaluated by the model include price increases, minimum unit prices, restrictions on special offers, restrictions on advertising and licensing hours as well as programmes of Screening and Brief Interventions (SBI) (Purshouse et al. 2013).

The SAPM is split into two principal components. The first simulates the effect of a policy on the alcohol consumption of the population. The second estimates the impact of this change in consumption on mortality and morbidity over 30 years for a range of alcohol-related health conditions. SBI policies are modelled with patients being screened on an opportunistic basis over the course of 10 years. The probability of any patient screening positively is estimated from statistical models based on their age, gender and alcohol consumption. These models were re-estimated for this WP using newly available data from the 2007 UK Psychiatric Morbidity Survey.

2.2 Model adaptation

When adapting any health economic model to multiple country contexts as in this WP, it is first necessary to address the issue of model specificity versus between-country comparability. Following a series of discussions between all WP3 collaborating partners it was decided that the following would be standardised across all 3 countries:

- The alcohol-attributable health conditions included in the model. These were taken from the global burden of disease work of the World Health Organisation (Ezzati & Lopez 2005; Rehm & Mathers 2009) and are listed in Appendix A.
- The SBI policies modelled. 2 policies were modelled in each country - one of screening at next registration with a new general practitioner/family doctor (GP) and one of screening at next consultation with a GP.
- The perspective of analysis. Each model considers only the impact of SBI programmes on the healthcare sector (i.e. costs of practitioners' time in delivering the SBI, costs of subsequent savings to the healthcare sector in reduced alcohol-related healthcare usage and improved health-related quality of life amongst the population, measured in Quality-Adjusted Life Years (QALYs)). Wider societal costs, such as the impact on crime or workplace absenteeism are not included. This is likely to underestimate the net benefit of SBI programmes to society as a whole.

In all other aspects each model was tailored to provide the most accurate representation possible of the country being modelled, both in terms of the data used to populate the model as well as the nature of the policy being modelled. For example, both the screening and brief intervention aspects of the policy were modelled according to relevant local guidelines, in terms of the screening tool used, the nature and duration of the intervention delivered and the staff delivering the SBI. In all cases where local data or guidelines were not available we consulted with local collaborators to ensure the most appropriate alternative assumptions were made.

3. Italian Model

3.1 Methods

3.1.1 Background

National guidelines in Italy already recommend the use of SBIs in primary care as a tool to tackle hazardous alcohol consumption (Ministero della Salute 2007). However, the Italian healthcare system is highly regionalised, with decision makers in each of the 20 regions having responsibility for the distribution of healthcare spending, and the current level of SBI provision is very low in most regions.

3.1.2 Modelled SBI policy

Existing Italian guidelines for the provision of SBIs recommend screening with the Alcohol Use Disorders Identification Test - Consumption questionnaire (AUDIT-C) with a score of 5 or more for men and 4 or more for women constituting a positive screen (Struzzo et al. 2006). Patients screening positively then receive a 10 minute intervention (Scafato et al. 2006). It was assumed that both screening and intervention component are delivered by a GP as a part of a patient's normal consultation. In line with national guidelines for economic evaluations all costs and health outcomes were discounted at a rate of 3%, with results reported for 0% and 5% as sensitivity analyses (Capri et al. 2001). All costs are presented in 2008 prices.

3.1.3 Consumption data

We obtained consumption data for the Italian population from the Aspects of Daily Life survey 2008 (ISTAT 2008; Scafato et al. 2009), conducted by the Italian national statistics institute (ISTAT). This nationally representative survey (N=48,861) records demographic data on each respondent as well as asking a series of quantity-frequency questions regarding their usual alcohol consumption. These responses were converted to a mean weekly consumption in grams of alcohol. The survey also asks respondents how many times in the preceding year they have drunk 6 or more glasses of alcoholic beverage (1 glass = 12 grams of alcohol). We used this as a measure of the risk of harm for health conditions associated with acute, rather than chronic, alcohol consumption.

3.1.4 Mortality and morbidity data

Absolute mortality data for the 42 alcohol-related health conditions included in the model was obtained for 2008 from ISTAT, together with all-cause mortality rates, split by age group and gender. Morbidity data was derived from the Italian database of hospital admissions for 2008, which contained a total of 1559310 admissions for 33 of the alcohol-related health conditions. Data on the remaining 9 health conditions was unavailable as the relevant International Classification of Disease (ICD) codes are not used in patients' records in Italy. In order to account for repeat admissions in the same year for the same individual, the absolute number of admissions was divided by an adjustment coefficient representing the mean number of hospital admissions in a year for a patient with each health condition. Details of the derivation of these adjustment coefficients is presented in Appendix B. Morbidity rates for the 9 partially-attributable acute conditions for which Italian data was unavailable were estimated from UK morbidity data using the relationship between Italian and UK mortality rates by age and gender for each relevant condition.

3.1.5 Alcohol-attributable fractions

The Alcohol-Attributable Fraction (AAF) is a measure of the proportion of a disease which is attributable to alcohol. The SAPM requires AAFs for each of the 9 partially-alcohol-attributable

acute health conditions included in the model. An Italian study in 2009 calculated AAFs for a range of conditions, including motor vehicle accidents, fall injuries, drowning, accidental poisoning by exposure to noxious substances, other unintentional injuries, intentional self-harm (including suicide) and assault (including homicide) (Scafato et al. 2009). For fire injuries and other intentional injuries Italian AAFs were unavailable, so the English AAFs of Jones et al. (2008) were used.

3.1.6 Healthcare costs for alcohol-related morbidity

The model incorporates all healthcare costs to the INHS for each health condition, including inpatient, outpatient and accident and emergency visits, ambulance costs, GP consultations, nurse visits and other costs. In Italy, hospitals are funded through reimbursement tariffs that vary across 21 regions and between different types of providers. The reimbursement tariffs are estimated on the basis of full cost of hospitalisation and are inclusive of all inpatient services in addition to emergency visits if these led to hospitalisation (Fattore & Torbica 2006). In order to obtain nationally representative estimates, hospital costs were assigned to each admission in the national admissions database based on the nationally defined reimbursement tariff which applies when a patient is treated outside their region of residence. As for morbidity data, only 33 of the 42 health conditions in the model were available in this dataset.

Mean costs were calculated for each condition by gender and tested for significant differences between sexes using student t-tests. Costs were significantly different ($p<0.01$ in all cases) for 11 of the conditions for which data was available. Where there was no significant difference ($p>0.23$ in all cases) the overall population mean was used. For remaining partially acute conditions where no cost data was available in Italy, English costs (Purshouse et al. 2009) were adjusted by the mean ratio between Italian and English costs for other conditions. Costs not covered within the hospital reimbursement tariffs (e.g. ambulance and GP costs) were estimated assuming the ratio of hospital admission to other costs for each condition was the same as in England. This assumption was tested in a sensitivity analysis assuming, conservatively, that these costs were 25% lower than the baseline estimates.

3.1.7 SBI delivery costs

The costs associated with implementing a screening and brief intervention programme were separated into the cost of briefing materials provided to the patient and the cost of the GP's time. The former were taken from a UK study by Lock et al. (2006), converted into euros using OECD purchasing power parities (OECD 2013) and inflated to 2008 prices using the consumer prices index for Italy (www.inflation.eu 2013). To obtain an estimate of the GPs time, we first estimated the annual salaries of GPs of different levels of seniority, using data from the Friuli-Venezia-Giulia (FVG) region of Italy. We took an average of these, weighted by the proportion of GPs at each level in the province of Udine (in the FVG region) to give us an estimate for the mean annual salary of a GP of €79937 before tax. Italian GPs spend an average of 15 hours contact time in surgery with patients (Ministero della Salute 1999) and an estimated 12.5 hours on home visits, giving us an average direct cost per minute to the INHS €0.87 for this contact time (after adjusting to 2008 prices). As no data exists on the costs of overheads and other related costs (such as ongoing training) these were estimated relatively from UK figures (Curtis 2008), giving a total cost per minute to the INHS of €1.07. Owing to the uncertainty around this figure, an alternative estimate of €1.58, derived using the absolute UK costs, was used as a sensitivity analysis.

3.1.8 SBI programme coverage

In order to estimate the population coverage of programmes of SBIs at next GP registration and next GP consultation it was necessary to estimate the proportion of each age-gender subgroup of the population who either register with or visit a GP in each of the 10 years of the modelled policy. Data on between-GP migration by patient age and gender was obtained for the Friuli-Venezia-Giulia region for a 10 year period from 2000-2009 (personal communication from Roberto Maffetone at INSIEL) together with regional population demographics for the same period from ISTAT. These were used to derive a gender and age-group specific 'arrival profile', after adjusting for long-term trends in migration, giving the probability of being screened in each year of a 10 year screening programme, assuming that the probability of registering with a new GP was independent from year to year. Data on the frequency of GP consultations by age and gender was obtained for both Italy (Brignoli et al. 2010) and England (Hippisley-Cox & Vinogradova 2009) and used to estimate the proportion of patients in each subgroup who would visit their GP in each year of the programme. Full details of the methodology used in this estimation are given in Appendix C.

3.1.9 Brief intervention properties

No published Italy-specific effectiveness studies for SBIs in primary care could be identified, therefore the central estimate of a reduction in consumption of 12.3% following a brief intervention, taken from the Cochrane review of Kaner et al. (2007), was used. This review found no significant relationship between duration of intervention and effectiveness; however a non-significant meta-regression estimated that a 10 minute intervention would lead to a reduction in mean alcohol consumption of 7.5%. This value is used in a sensitivity analysis, as well as the assumption that a 24.9 minute intervention (the mean duration of interventions in the Cochrane review) is required to achieve the 12.3% effect. In line with evidence from Fleming et al. (2002) any reduction in consumption is assumed to decay linearly over 7 years to the age-adjusted pre-intervention consumption level. A further sensitivity analysis is conducted in which this duration of effect is reduced to 3 years.

3.1.10 Sensitivity analyses and alternative assumptions

In order to fully examine both the uncertainty around the assumptions which underpin the Italian model and the impact of alternative implementation assumptions for an SBI programme, a wide range of sensitivity analyses were conducted in which alternative plausible values or assumptions are made and their impact on the model results explored. The alternative values used are all pessimistic compared to the model base case, to represent 'worst-case' scenarios for the inputs in question. Table 3.1 shows a breakdown of the alternative scenarios analysed for each of the two modelled SBI programmes.

Table 3.1 - Scenario analyses around key modelling parameters

Scenario	Hospital Costs	GP Costs	Intervention Duratio	BI Effectiveness	BI Duration of Effect
Baseline	Baseline estimates	€1.07	10 minutes	-12.3%	7 years
Alternative 1	Baseline estimates	€1.07	10 minutes	-7.5%	7 years
Alternative 2	Baseline estimates	€1.07	10 minutes	-12.3%	3 years
Alternative 3	Baseline estimates	€1.07	10 minutes	-7.5%	3 years
Alternative 4	Baseline -25%	€1.07	10 minutes	-12.3%	7 years
Alternative 5	Baseline -25%	€1.07	10 minutes	-7.5%	7 years
Alternative 6	Baseline -25%	€1.07	10 minutes	-12.3%	3 years
Alternative 7	Baseline -25%	€1.07	10 minutes	-7.5%	3 years
Alternative 8	Baseline estimates	€1.58	10 minutes	-12.3%	7 years
Alternative 9	Baseline estimates	€1.58	10 minutes	-7.5%	7 years
Alternative 10	Baseline estimates	€1.58	10 minutes	-12.3%	3 years
Alternative 11	Baseline estimates	€1.58	10 minutes	-7.5%	3 years
Alternative 12	Baseline estimates	€1.07	24.9 minutes	-12.3%	7 years
Alternative 13	Baseline estimates	€1.07	24.9 minutes	-7.5%	7 years
Alternative 14	Baseline estimates	€1.07	24.9 minutes	-12.3%	3 years
Alternative 15	Baseline estimates	€1.07	24.9 minutes	-7.5%	3 years
Alternative 16	Baseline -25%	€1.58	24.9 minutes	-12.3%	7 years
Alternative 17	Baseline -25%	€1.58	24.9 minutes	-7.5%	7 years
Alternative 18	Baseline -25%	€1.58	24.9 minutes	-12.3%	3 years
Alternative 19	Baseline -25%	€1.58	24.9 minutes	-7.5%	3 years

Scenario analysis is also used to examine the impact of alternative implementation options for an SBI policy, specifically the choice of screening instrument and threshold. The following alternatives were modelled to the current AUDIT-C tool for each SBI programme to establish whether an alternative choice of screening tool may provide better results:

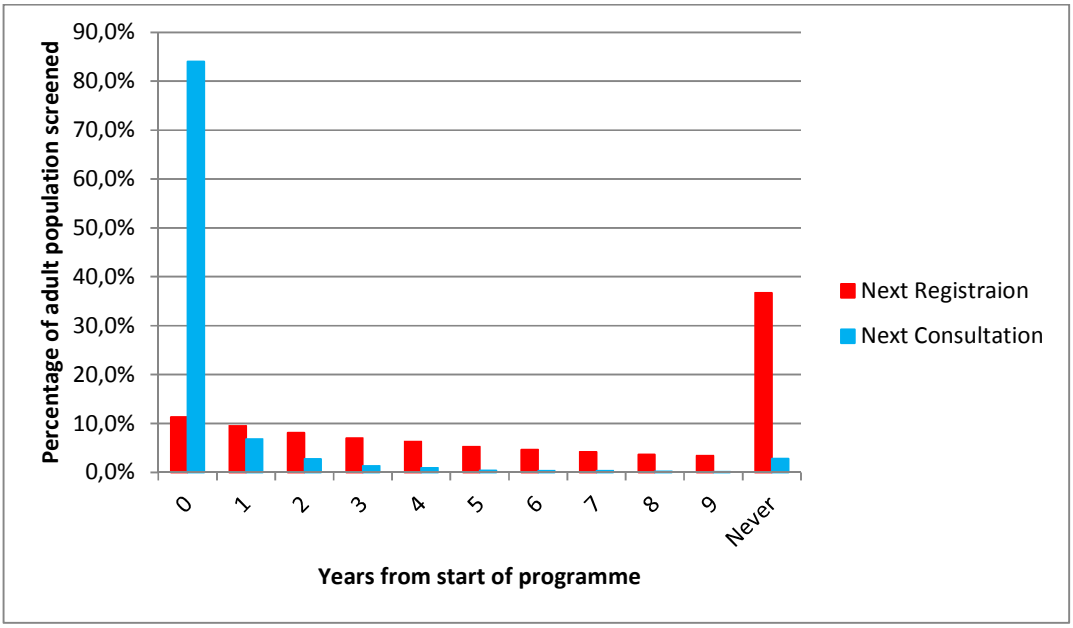
- AUDIT with a threshold of 8
- AUDIT with a split threshold of 8 for men and 6 for women
- AUDIT-C with thresholds of 5 and 4 followed by the full AUDIT with a threshold of 8 for those screening positive on the AUDIT-C
- FAST with a threshold of 3
- FAST with a threshold of 3 followed by the full AUDIT with a threshold of 8 for those screening positive on FAST

3.2 Results

3.2.1 Population coverage

The population coverage for a programme of screening at next GP registration is estimated to be 63% of the total adult population, leading to 32% of people receiving a brief intervention, during the 10 years of the programme. Coverage is spread relatively evenly across the 10 years, peaking in year 1 with 11% of the population being screened. A programme of screening at next consultation is estimated to capture 97% of the population over 10 years, with 49% of adults receiving an intervention as a result; however this is heavily loaded towards the start of the programme, with 84% of people being screened in the first year. Figure 3.2 shows these coverage profiles over the lifetime of the programme.

Figure 3.2 - Population coverage of modelled screening programmes



3.2.2 Screening at next GP registration

Over the course of 30 years, a programme of screening at next GP registration is estimated to result in 7193 fewer alcohol-attributable deaths, predominantly amongst men (66%) and from chronic (68%), rather than acute causes. The total number of hospitalisations saved by the programme is estimated to be 91737, also largely amongst men (72%) and for chronic conditions (67%). Table 3.3 gives a detailed breakdown of the estimated impact on alcohol-related morbidity in the fifth year of the programme.

Figure 3.3 - Estimated reductions in morbidity (absolute and relative to baseline) in the 5th year of a programme of patients being screened at their next GP registration

	16-24 years				25-44 years				45-64 years				65 years or older				Total					
	M		F		M		F		M		F		M		F		M		F		All	
Condition	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Alcoholic poisoning	0	-1.7%	0	-3.1%	-1	-3.1%	0	-4.9%	-1	-4.0%	-2	-12.2%	-1	-6.5%	0	-2.4%	-2	-3.5%	-2	-6.4%	-4	-4.6%
Alcoholic disorders	-12	-2.2%	-9	-2.8%	-204	-3.3%	-93	-4.0%	-259	-3.3%	-182	-5.5%	-132	-2.9%	-104	-2.6%	-608	-3.2%	-388	-3.9%	-996	-3.4%
Assault	-59	-0.4%	-16	-1.0%	-199	-1.1%	-52	-2.0%	-73	-1.7%	-13	-1.9%	-17	-2.3%	-4	-0.8%	-348	-0.9%	-84	-1.6%	-432	-1.0%
Road traffic accidents	-92	-1.2%	-10	-0.5%	-151	-1.2%	-16	-0.5%	-52	-0.9%	-8	-0.4%	-23	-0.8%	-9	-0.4%	-318	-1.1%	-44	-0.4%	-362	-0.9%
Epilepsy	-30	-1.4%	-2	-0.1%	-46	-1.5%	-3	-0.1%	-29	-0.9%	-6	-0.3%	-29	-0.8%	-5	-0.1%	-134	-1.1%	-16	-0.1%	-150	-0.6%
Other accidents	-37	-0.3%	-12	-0.3%	-217	-0.8%	-74	-0.7%	-232	-1.0%	-129	-0.8%	-894	-1.3%	-168	-0.1%	-1380	-1.1%	-382	-0.2%	-1762	-0.6%
Intentional self-harm	-6	-0.2%	-18	-0.3%	-36	-0.5%	-64	-0.7%	-20	-0.7%	-25	-0.7%	-12	-1.0%	-5	-0.3%	-74	-0.5%	-112	-0.6%	-186	-0.5%
Diseases of the digestive system	-5	-0.5%	1	0.0%	-82	-0.6%	6	0.0%	-145	-0.5%	2	0.0%	-102	-0.3%	-27	-0.1%	-334	-0.4%	-19	0.0%	-353	-0.2%
Diseases of the circulatory system	-27	-1.3%	-1	-0.1%	-82	-0.4%	-11	-0.1%	-578	-0.4%	-218	-0.3%	-398	-0.1%	-211	-0.1%	-1085	-0.2%	-440	-0.1%	-1525	-0.2%
Neoplasms	0	-0.2%	0	-0.1%	-3	-0.3%	-5	-0.1%	-52	-0.3%	-14	-0.1%	-16	0.0%	-11	0.0%	-71	-0.1%	-30	0.0%	-101	-0.1%
Other	-1	-0.3%	0	0.0%	-6	-0.4%	-2	0.0%	-5	-0.2%	-2	-0.1%	-2	-0.2%	-1	-0.1%	-14	-0.3%	-4	0.0%	-18	0.0%
Diabetes	3	0.1%	0	0.0%	11	0.2%	1	0.0%	28	0.2%	2	0.0%	27	0.1%	3	0.0%	69	0.2%	7	0.0%	76	0.1%
Total	-266	-0.6%	-66	-0.3%	-1016	-0.8%	-312	-0.3%	-1418	-0.5%	-596	-0.4%	-1599	-0.3%	-540	-0.1%	-4299	-0.5%	-1514	-0.2%	-5813	-0.3%

Included ICD-10 codes: (1) T51.0, T51.1, T51.9, X45; (2) E24.4, R78.0, F10, G31.2, G62.1, G72.1, I42.6, K29.2, K70, K86.0; (3) X85-Y09, Y87.1; (4) V0-V04, V06, V09-V80, V87, V89, V99; (5) G40-G41; (6) W00-W19, W65-W74, X00-X49, V05, V07, V08, V81-V86, V88, V90-V98, W20-W64, W75-W99, X10-X39, X50-X59, Y40, Y86, Y88, Y89; (7) X60-X84, Y87.0; (8) I10-I15, I20-I25, I47-I49, I60-I63; (9) I85, K74, K80, K85, K86.1; (10) C00-C15, C18-22, C32, C50; (11) L40 excl. L40.5, O03, Y35 (12) E10-E14

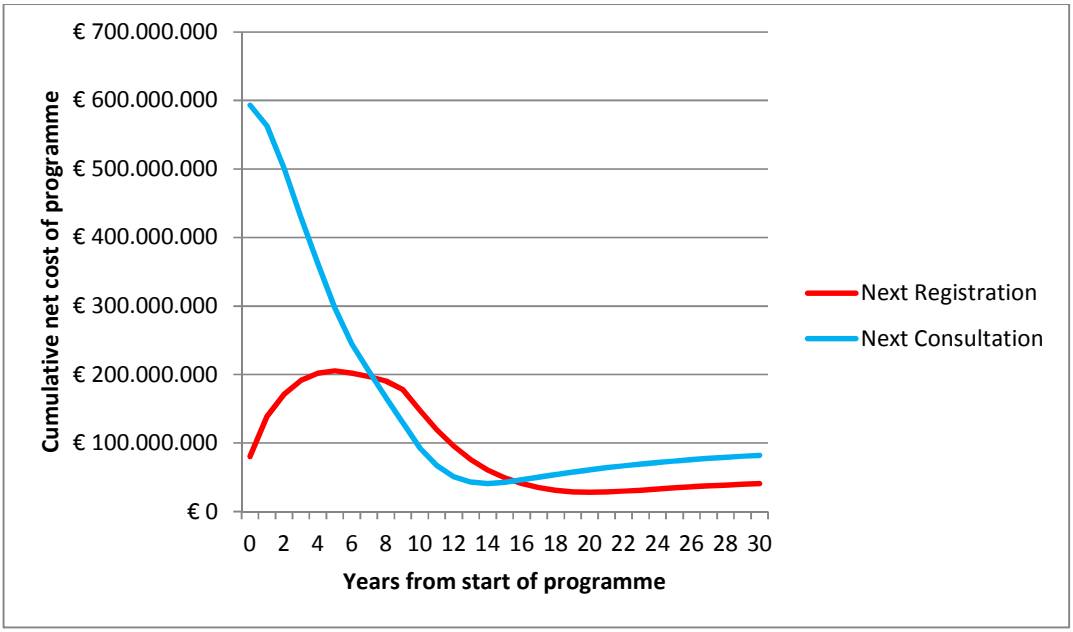
The cost of delivering SBIs over the 10 year programme is estimated to be €411 million. This is offset by a total reduction in hospital costs over 30 years of €370 million, giving a net cost of €41 million. The total gain in Quality-Adjusted Life Years (QALYs) is estimated to be 75200. The incremental cost per additional QALY gained (referred to as the Incremental Cost-Effectiveness Ratio (ICER)) is therefore 41000000/75200, which is €545/QALY. Most countries have some concept of the societal willingness-to-pay to 'purchase' an extra year of life in full health against which the costs of drugs and interventions can be compared. In Italy this value is €25000-€40000/QALY (Associazione Italiana di Economica Sanitaria (AIES) 2009). The cost of the modelled SBI programme is considerably lower than this threshold, suggesting that it would be a very cost-effective option.

As a large proportion of the health benefits are experienced by men (69% of total QALYs), delivering SBIs to men only is estimated to be cost-saving, although the estimated ICER for a female-only SBI programme of €3094/QALY is still well within the recommended Italian threshold.

3.2.3 Screening at next GP consultation

As a programme of SBI at next GP consultation has a wider coverage, it is estimated to produce even greater improvements in public health, with 12432 fewer alcohol-attributable deaths and 153676 fewer hospital admissions over 30 years. The cost of delivery is also higher, at €687 million, although this is offset by cumulative healthcare savings of €605 million, making the programme around twice as expensive as screening at next registration. Health savings are estimated to be 139204 additional QALYs, giving an ICER of €588/QALY and suggesting there is little to choose between the two programmes in terms of cost-effectiveness. It should be noted that as the majority of SBIs take place in the first year of the programme, the bulk of the delivery costs are incurred up front, whilst the healthcare savings are accrued over a longer time frame. This is in contrast to screening at next registration, where the SBI costs are spread more evenly across the duration of the programme. Figure 3.4 shows the cumulative net costs of both programmes over time.

Figure 3.4 - Cumulative net costs of modelled screening programmes (implementation costs and cost savings to healthcare provider)



3.2.4 Sensitivity analyses - discount rate

In order to investigate the sensitivity of model results around the baseline Italian discount rate of 3%, guidelines recommend alternative rates of 0% and 5% being tested. For a programme of screening at next registration a rate of 0% makes the programme cost-saving, whilst 5% increases the estimated ICER to €1200/QALY. For screening at next consultation similarly small effects are observed with 0% and 5% leading to estimates of €63 and €1144/QALY respectively.

3.2.5 Sensitivity analyses - model assumptions

Whilst the assumptions in the base case scenarios are the best representation of the available evidence, a range of further analyses have been performed using more pessimistic assumptions around the effect, duration and duration of effect of the intervention as well as the length of the intervention and the staff costs of the GPs delivering the SBIs. Results of these analyses are presented in Table 3.5, showing that even under the most pessimistic of assumptions is it likely that either programme would be likely to be considered cost-effective under current Italian guidelines (Associazione Italiana di Economica Sanitaria (AIES) 2009).

Table 3.5 - Impact of pessimistic alternative assumptions for SBI delivery costs and effectiveness estimates: ICERs versus a 'do-nothing' scenario

Next Registration	Base case	Lower hospital costs (-25% for estimated values)	Higher GP costs (€1.58/min)	Longer intervention (24.9 min)	Longer intervention, higher GP costs & cheaper hospital costs
Base case	€ 545	€ 1036	€ 2009	€ 3892	€ 7441
Less effective (5.9% reduction)	€ 3576	€ 4060	€ 5853	€ 8785	€ 14031
Shorter effect (3 year rebound)	€ 7514	€ 8000	€ 10819	€ 15072	€ 22465
Less effective & shorter effect (5.9% reduction & 3 year rebound)	€ 14284	€ 14763	€ 19404	€ 25991	€ 37167

Next Consultation	Base case	Lower hospital costs (-25% for estimated values)	Higher GP costs (€1.58/min)	Longer intervention (24.9 min)	Longer intervention, higher GP costs & cheaper hospital costs
Base case	€ 588	€ 953	€ 1910	€ 3607	€ 6732
Less effective (5.9% reduction)	€ 2504	€ 3,665	€ 5350	€ 7980	€ 12622
Shorter effect (3 year rebound)	€ 5860	€ 7390	€ 10058	€ 13949	€ 20643
Less effective & shorter effect (5.9% reduction & 3 year rebound)	€ 11600	€ 13550	€ 17870	€ 23880	€ 33871

3.2.6 Sensitivity analyses - alternative implementation options

Table 3.6 presents the results of a range of alternative model runs, showing the estimated impact of using alternative screening tools and thresholds. These results show that whilst the current recommended screening tool in Italy (AUDIT-C 5/4) is the most expensive to implement, it is also the most effective and produces the greatest net benefit for both screening at next registration and at next consultation. The results also illustrate the scale of potential net benefits from adopting a national SBI policy (estimated to be in excess of €1.3bn at a willingness-to-pay threshold of €25000/QALY for any of the modelled scenarios).

Table 3.6 - Model results for alternative implementation scenarios, ordered by incremental net benefit

Setting	Screening tool and threshold (M/F)	Delivery costs (€m)	INHS Savings (€m)	Net cost to INHS (€m)	QALY gains ('000s)	Incremental net benefit versus do-nothing (€m)*
Registration	FAST 3 & AUDIT 8	254	299	-45	57	1378
Registration	FAST 3	259	297	-39	57	1381
Registration	AUDIT 8	284	321	-38	62	1520
Registration	AUDIT 8/6	316	321	-5	62	1555
Registration	AUDIT-C 5/4 & AUDIT 8	356	338	17	67	1680
Registration	AUDIT-C 5/4	411	370	41	75	1921
Consultation	FAST 3 & AUDIT 8	419	503	-84	111	2684
Consultation	FAST 3	422	505	-84	111	2694
Consultation	AUDIT 8	470	500	-30	121	3000
Consultation	AUDIT 8/6	529	544	-15	122	3030
Consultation	AUDIT-C 5/4 & AUDIT 8	595	519	76	127	3258
Consultation	AUDIT-C 5/4	687	605	82	139	3562

Highlighted rows are baseline models

* Assuming a willingness-to-pay of €25000/QALY

3.3 Discussion

3.3.1 Summary of results

This adaptation of SAPM provides the first cost-effectiveness analysis of screening and brief intervention programmes in Italy, examining two implementation options: screening at the next registration with a new GP or screening at the next GP consultation. The outcome measures observed were the costs of screening, the reduction in costs to the INHS as a result of reduced morbidity and mortality and the improvement in health outcomes measured in QALYs, in line with standard practice in Italian cost-effectiveness analyses (Capri et al. 2001). The resulting incremental cost-effectiveness ratios for all scenarios suggest that either of the modelled SBI programmes would be highly cost-effective when compared with a policy of no SBI, under current Italian guidelines (Associazione Italiana di Economica Sanitaria (AIES) 2009), with a policy of SBI at next consultation, using the current AUDIT-C 5/4 screening tool bringing the greatest net benefit of all modelled options (at a willingness-to-pay threshold of €25000/QALY).

3.3.2 Limitations

The principal challenges to this analysis were those presented by the availability of Italian data with which to adapt the existing English model. Whilst every effort was made to obtain suitable data specific to the Italian context this was not always possible, and a number of assumptions had to be made regarding the similarities of the English and Italian health care systems. The validity of these assumptions was discussed with the Italian collaborating partners to ensure that they were plausible and the uncertainty around key assumptions was tested using sensitivity analyses. There are a number of additional limitations which are common to all 3 of the model adaptations undertaken as part of WP3. These are discussed in Section 6.3.

3.3.3 Conclusions

These results show that a programme of SBI in primary care in Italy is highly likely to be cost-effective; however the ICER does not tell the whole story and decision makers in Italy should be mindful of the differing cost implications of the alternative programmes modelled. Whilst screening at next GP consultation brings the greatest health benefits and affects the largest number of people, it also carries a heavily front-loaded resource profile, whereas implementing screening at next GP registration offers a much more even spread of resourcing over the duration of the programme. These differences may have a major effect on the acceptability of different SBI programme options to decision makers attempting to balance limited health care budgets.

4. Dutch Model

4.1 Methods

4.1.1 Background

Current national guidance produced by the Dutch College of General Practitioners (NHG) recommends screening only when a patient presents physical or mental indicators of heavy drinking (NHG 2005). This has contributed to a low level of SBI delivery amongst practitioners, although more recent evidence suggests that a much wider, opportunistic delivery of SBIs is likely to be a cost-effective option (Tariq et al. 2009).

4.1.2 Modelled SBI policy

Existing Dutch guidelines for the provision of SBIs recommend screening with the Alcohol Use Disorders Identification Test with a score of 8 for men under 65 and 5 for women and men over 65 constituting a positive screen (Trimbos-Instituut 2009). All patients screening positively receive a 10 minute brief intervention. Both the screening and intervention components are likely to be delivered in practice by either a practice nurse or a GP. Unfortunately robust data on the cost of screening with nurses could not be identified and therefore the model focuses on GP-delivered SBIs. It is likely in practice that the direct costs of utilising practice nurses as delivery staff is less than GPs, whilst there is evidence to suggest that the quality of care they deliver is at least equal to that of GPs (Laurant et al. 2009), suggesting that the results of the WP3 model may under-estimate the actual cost-effectiveness of an SBI programme in the Netherlands. In line with national guidelines for economic evaluations all costs and health outcomes were discounted at rates of 4% and 1.5% respectively (College Voor Zorkverzekeringen 2010), and all costs are presented in 2010 prices.

4.1.3 Consumption data

We obtained consumption data for the Dutch population from the Survey of Living Conditions (POLS) 2008 and 2009, conducted by the Dutch Central Bureau of Statistics (CBS). This nationally representative survey records demographic data on each respondent as well as asking a series of quantity-frequency questions regarding their usual alcohol consumption. These responses were converted to a mean weekly consumption in grams of alcohol. The survey also asks respondents how many times in the preceding 6 months they have drunk 6 or more glasses of alcoholic beverage. We used this as a measure of the risk of harm for health conditions associated with acute, rather than chronic, alcohol consumption.

4.1.4 Mortality and morbidity data

Absolute mortality data from 2008 for the 42 health conditions was obtained from CBS for each age and gender subgroup in the model. Morbidity data was derived from the Dutch Hospital Data Foundation (DHD) database of hospital admissions for 2010, which contained a total of 888838 admissions for the 42 alcohol-related health conditions (Dutch Hospital Data 2010). DHD classify all admissions in the database as either 'Day' or 'Clinical' and they estimate the separate coverage rates for each (i.e. the proportion of all admissions nationally which are included in the database) to be 85.8% and 89.1% respectively. For each health condition the total number of admissions is calculated and then upshifted using the observed proportion of 'Day' and 'Clinical' admissions for that condition to estimate the number of 'missing' admissions. In addition, in order to account for repeat admissions in the same year for the same individual, the estimated total number of admissions was divided by the adjustment coefficients, representing the mean number of admissions in a year for an individual with each health condition, presented in Appendix A.

4.1.5 Healthcare costs for alcohol-related morbidity

The model incorporates all healthcare costs to the Dutch healthcare system for each health condition, including inpatient, outpatient and accident and emergency visits, ambulance costs, GP consultations, nurse visits and other costs. Owing to the nature of the Dutch system, in which majority of the reimbursement tariff for each treatment are negotiated individually between the insurers and the healthcare providers, it was not possible to obtain a representative estimate of the mean cost of treatment for the 42 conditions included in the model. The costs of hospitalisation estimated for the previous English version of the model have therefore been used (inflated to 2010 prices and converted to Euros) (Purshouse et al. 2013). As there is considerable uncertainty around the suitability of these prices as a proxy for Dutch costs, a range of sensitivity analyses are conducted around this assumption in order to test its impact on the model results.

4.1.6 SBI delivery costs

The costs associated with implementing a screening and brief intervention programme were separated into the cost of briefing materials provided to the patient and the cost of the GP's time. The former were taken from a UK study by Lock et al. (Lock et al. 2006), converted into euros using OECD purchasing power parities (OECD 2013) and inflated to 2010 prices using the consumer prices index for the Netherlands (www.inflation.eu 2013). The opportunity cost of the GPs time in delivering the SBI was estimated to be €2.80 per minute based on a national estimate of €28 for a 10 minute consultation(College Voor Zorkverzekeringen 2010).

4.1.7 SBI programme coverage

In order to estimate the population coverage of programmes of SBIs at next GP registration and next GP consultation it was necessary to estimate the proportion of each age-gender subgroup of the population who either register with or visit a GP in each of the 10 years of the modelled policy. Two datasets, containing data on GP registrations and GP consultations respectively were obtained from the Netherlands Information Network of General Practice (LINH) and relate to a representative sample of 125 practices across the Netherlands:

i) The next registration dataset includes the number of new patients, by age and gender, registering with each practice in each of the 10 years from 2001-2010, together with the total number of patients registered at the practice. From this data, under the assumption that the probability of registering with a new GP in any given year was independent of any other year, the proportion of each age-gender subgroup who register with a new GP in each year of a 10 year programme could be estimated.

ii) The next consultation dataset includes the 27 GP practices out of 125 included in the LINH data which had complete patient records for the years 2006-2010 and includes 84825 individual patients who remained registered with these practice for these 5 years. The age-gender mix of patients for these 27 practices was checked against national-level data (CBS n.d.) to ensure the data was representative of the wider population. For each age-gender subgroup in the model, the dataset records the proportion of patients who first consulted with a GP in each of the 5 years (e.g. patients who consulted a GP in 2008 having not had a previous consultation in the years 2006-2007). In order to estimate a 10 year coverage profile from this data, a Weibull distribution was fitted to the observed 5 year data and extrapolated to give the coverage across 10 years. Alternative distributional assumptions were

tested, however the Weibull distribution provided the best fit to the observed data across all age-gender subgroups.

4.1.8 Brief intervention properties

No published Netherlands-specific effectiveness studies for SBIs in primary care could be identified, therefore the central estimate of a reduction in consumption of 12.3% following a brief intervention, taken from the Cochrane review of Kaner et al. (2007), was used. This review found no significant relationship between duration of intervention and effectiveness; however a non-significant meta-regression estimated that a 10 minute intervention would lead to a reduction in mean alcohol consumption of 7.5%. This value is used in a sensitivity analysis, as well as the assumption that a 24.9 minute intervention (the mean duration of interventions in the Cochrane review) is required to achieve the 12.3% effect. In line with evidence from Fleming et al. (2002) any reduction in consumption is assumed to decay linearly over 7 years to the age-adjusted pre-intervention consumption level. A further sensitivity analysis is conducted in which this duration of effect is reduced to 3 years.

4.1.9 Sensitivity analyses and alternative assumptions

In order to investigate the impact of uncertainty around the estimated hospital costs, the duration and magnitude of effect of the intervention on patients' drinking and the relationship between these and the duration of the brief intervention itself, we conducted a number of sensitivity analyses using more pessimistic assumptions for these parameters. Table 4.1 shows a breakdown of the alternative scenarios analysed for each of the two modelled SBI programmes.

Table 4.1 - Scenario analyses around key modelling parameters

Scenario	Hospital Costs	Intervention Duratio	BI Effectiveness	BI Duration of Effect
Baseline	Baseline estimates	10 minutes	-12.3%	7 years
Alternative 1	Baseline estimates	10 minutes	-7.5%	7 years
Alternative 2	Baseline estimates	10 minutes	-12.3%	3 years
Alternative 3	Baseline estimates	10 minutes	-7.5%	3 years
Alternative 4	Baseline -25%	10 minutes	-12.3%	7 years
Alternative 5	Baseline -25%	10 minutes	-7.5%	7 years
Alternative 6	Baseline -25%	10 minutes	-12.3%	3 years
Alternative 7	Baseline -25%	10 minutes	-7.5%	3 years
Alternative 8	Baseline estimates	24.9 minutes	-12.3%	7 years
Alternative 9	Baseline estimates	24.9 minutes	-7.5%	7 years
Alternative 10	Baseline estimates	24.9 minutes	-12.3%	3 years
Alternative 11	Baseline estimates	24.9 minutes	-7.5%	3 years
Alternative 12	Baseline -25%	24.9 minutes	-12.3%	7 years
Alternative 13	Baseline -25%	24.9 minutes	-7.5%	7 years
Alternative 14	Baseline -25%	24.9 minutes	-12.3%	3 years
Alternative 15	Baseline -25%	24.9 minutes	-7.5%	3 years

Scenario analysis is also used to examine the impact of alternative implementation options for an SBI policy, specifically the choice of screening instrument and threshold. The following alternatives were modelled to the AUDIT tool for each SBI programme to establish whether an alternative choice of screening tool may provide better results:

- AUDIT with a threshold of 8
- AUDIT with a split threshold of 8 for men and 6 for women
- AUDIT-C with thresholds of 5 and 4
- FAST with a threshold of 3

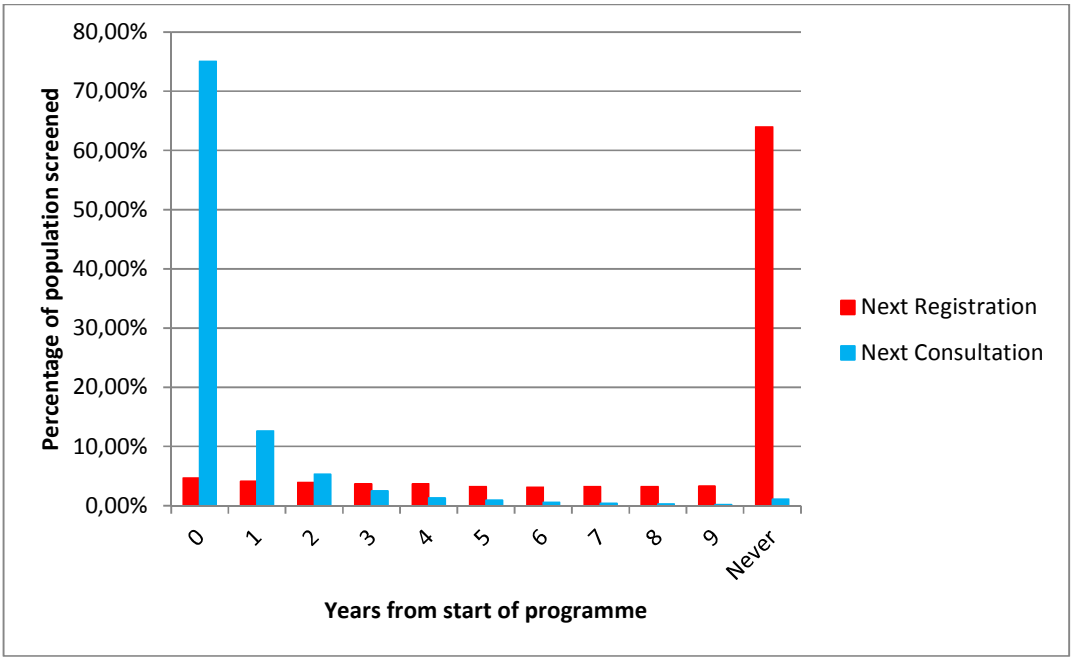
- FAST with a threshold of 3 followed by the full AUDIT with a threshold of 8 for those screening positive on FAST
- Five-Shot with a threshold of 3

4.2 Results

4.2.1 Population coverage

The population coverage for a programme of screening at next GP registration is estimated to be 36% of the total adult population, leading to 17% of people receiving a brief intervention during the 10 years of the programme. Coverage is spread relatively evenly across the 10 years, peaking in year 1 with 4.6% of the population being screened. A programme of screening at next consultation is estimated to capture 99% of the population over 10 years, with 34% of adults receiving an intervention as a result; however this is heavily loaded towards the start of the programme, with 75% of people being screened in the first year. Figure 4.2 shows these coverage profiles over the lifetime of the programme.

Figure 4.2 - Population coverage of modelled screening programmes



4.2.2 Screening at next GP registration

Over the course of 30 years, a programme of screening at next GP registration is estimated to result in 990 fewer alcohol-attributable deaths, predominantly from chronic (63%), rather than acute causes and distributed fairly evenly between the sexes (44% male, 56% female). The total number of hospitalisations saved by the programme is estimated to be 12100, with 62% of these for acute conditions and 51% among men. Table 4.3 gives a detailed breakdown of the estimated impact on alcohol-related morbidity in the fifth year of the programme.

Figure 4.3 - Estimated reductions in morbidity (absolute and relative to baseline) in the 5th year of a programme of patients being screened at their next GP registration

	16-24 years				25-44 years				45-64 years				65 years or older				Total					
	M		F		M		F		M		F		M		F		M		F		All	
Condition	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Alcoholic disorders	-16	-2.1%	-5	-2.3%	-39	-1.6%	-22	-2.7%	-73	-1.5%	-39	-1.9%	-52	-2.6%	-42	-4.7%	-180	-1.8%	-108	-2.7%	-288	-2.1%
Alcoholic poisoning	-2	-1.8%	-3	-2.3%	-4	-1.3%	-8	-3.0%	-2	-0.9%	-4	-1.7%	-1	-1.9%	-1	-3.7%	-9	-1.3%	-16	-2.4%	-25	-1.9%
Intentional self-harm	-2	-0.7%	-8	-0.9%	-4	-0.5%	-18	-1.2%	-2	-0.3%	-7	-0.6%	-1	-0.6%	-3	-1.2%	-9	-0.5%	-36	-0.9%	-45	-0.8%
Epilepsy	-2	-0.5%	0	-0.1%	-11	-1.0%	-1	-0.1%	-12	-0.6%	-2	-0.1%	-24	-1.1%	-2	-0.1%	-49	-0.9%	-5	-0.1%	-54	-0.5%
Assault	-4	-0.6%	-1	-0.7%	-4	-0.4%	-3	-1.1%	-1	-0.2%	-1	-0.5%	0	-0.5%	-1	-1.8%	-9	-0.4%	-6	-0.9%	-15	-0.5%
Other accidents	-29	-0.6%	-14	-0.6%	-49	-0.4%	-49	-0.7%	-49	-0.3%	-44	-0.3%	-68	-0.4%	-261	-0.7%	-195	-0.4%	-368	-0.6%	-563	-0.5%
Road traffic accidents	-4	-0.3%	-3	-0.4%	-8	-0.3%	-3	-0.2%	-2	-0.1%	-1	-0.1%	-1	-0.1%	0	0.0%	-15	-0.2%	-6	-0.1%	-21	-0.2%
Diseases of the circulatory system	-1	-0.1%	0	-0.1%	-9	-0.1%	-4	-0.1%	-52	-0.1%	-26	-0.1%	-118	-0.1%	-50	-0.1%	-179	-0.1%	-80	-0.1%	-259	-0.1%
Neoplasms	0	-0.1%	0	-0.1%	0	-0.1%	-1	-0.1%	-4	-0.1%	-5	-0.1%	-6	-0.1%	-4	-0.1%	-10	-0.1%	-9	-0.1%	-20	-0.1%
Diseases of the digestive system	0	-0.1%	1	0.1%	-2	-0.1%	5	0.1%	-5	-0.1%	0	0.0%	-8	-0.2%	-1	0.0%	-15	-0.1%	5	0.0%	-10	0.0%
Other	0	-0.1%	0	0.0%	0	-0.1%	0	0.0%	-1	-0.1%	0	-0.1%	0	-0.2%	0	-0.1%	-1	-0.1%	-1	0.0%	-2	0.0%
Diabetes	0	0.1%	0	0.0%	2	0.1%	1	0.0%	5	0.1%	1	0.0%	19	0.2%	4	0.0%	26	0.1%	5	0.0%	31	0.1%
Total	-61	-0.6%	-33	-0.5%	-127	-0.4%	-103	-0.3%	-198	-0.2%	-129	-0.2%	-260	-0.2%	-361	-0.2%	-646	-0.2%	-626	-0.2%	-1,272	-0.2%

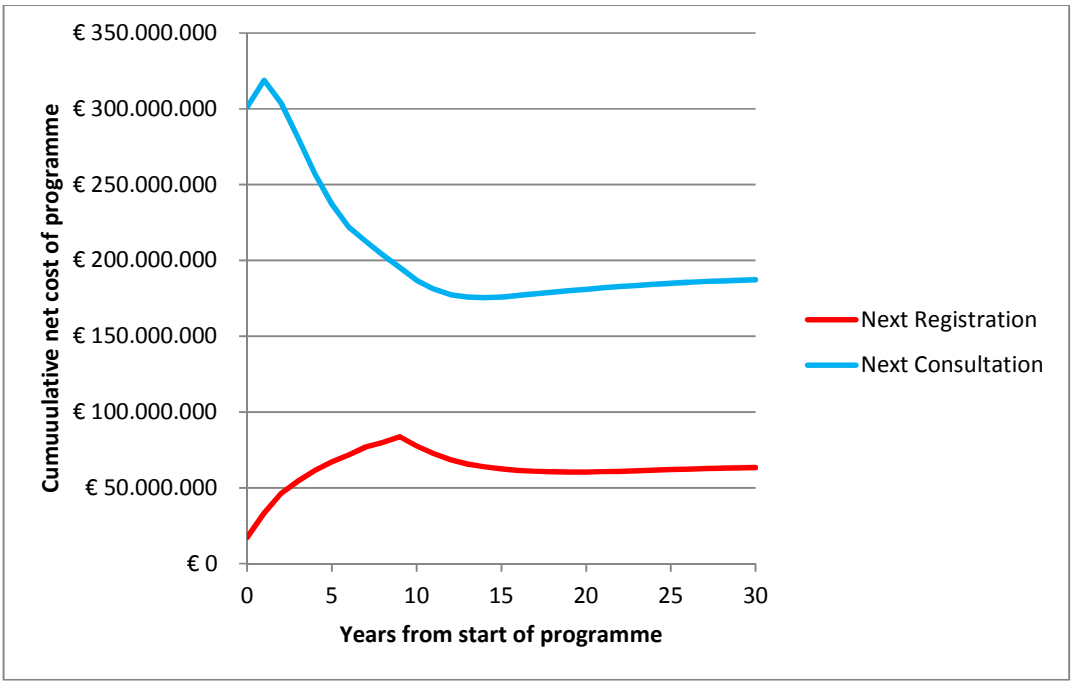
Included ICD-10 codes: (1) E24.4, R78.0, F10, G31.2, G62.1, G72.1, I42.6, K29.2, K70, K86.0; (2) T51.0, T51.1, T51.9, X45; (3) X60-X84, Y87.0; (4) G40-G41; (5) X85-Y09, Y87.1; (6) W00-W19, W65-W74, X00-X49, V05, V07, V08, V81-V86, V88, V90-V98, W20-W64, W75-W99, X10-X39, X50-X59, Y40, Y86, Y88, Y89; (7) V0-V04, V06, V09-V80, V87, V89, V99; (8) I10-I15, I20-I25, I47-I49, I60-I63; (9) C00-C15, C18-22, C32, C50; (10) I85, K74, K80, K85, K86.1; (11) L40 excl. L40.5, O03, Y35 (12) E10-E14

The cost of delivering SBIs over the 10 year programme is estimated to be €131 million. This is set against a total reduction in hospital costs over 30 years of €67 million, giving a net programme cost of €63 million. The total gain in Quality-Adjusted Life Years (QALYs) is estimated to be 10000 giving an incremental cost per additional QALY gained (referred to as the Incremental Cost-Effectiveness Ratio (ICER)) of €6340/QALY. Most countries have some concept of the societal willingness-to-pay to 'purchase' an extra year of life in full health. In the Netherlands this is €20000-30000 (Niessen et al. 2007). As the estimated cost is significantly below this threshold this suggests that such a programme would be considered highly cost-effective by Dutch decision makers.

4.2.3 Screening at next GP consultation

As a programme of SBI at next GP consultation has a substantially wider coverage, it is estimated to produce significantly greater improvements in public health, with 2870 fewer alcohol-attributable deaths and 39000 fewer hospital admissions over 30 years. The cost of delivery is also higher, at €399 million, although this is offset by cumulative healthcare savings of €212 million, making the programme around three times as expensive as screening at next registration. Health savings are estimated to be 30800 additional QALYs, Giving an ICER of €5748/QALY and suggesting there is little to choose between the two programmes in terms of cost-effectiveness. It should be noted that as the majority of SBIs take place in the first year of the programme, the bulk of the delivery costs are incurred up front, whilst the healthcare savings are accrued over a longer time frame. This is in contrast to screening at next registration, where the SBI costs are spread more evenly across the duration of the programme. Figure 4.4 shows the cumulative net costs of both programmes over time.

Figure 4.4 - Cumulative net costs of modelled screening programmes (implementation costs and cost savings to healthcare provider)



4.2.4 Sensitivity analyses - model assumptions

Whilst the assumptions in the base case scenarios are the best representation of the available evidence, a range of further analyses have been performed using more pessimistic

assumptions around the effect, duration and duration of effect of the intervention as well as the length of the intervention and the costs of hospitalisation. Results of these analyses are presented in Table 4.5, showing that only when multiple pessimistic assumptions are combined would the programme not be considered cost-effective under current guidelines.

Table 4.5 - Impact of pessimistic alternative assumptions for SBI delivery costs and effectiveness estimates: ICERs versus a 'do-nothing' scenario

Next Registration	**Base case**	**Lower hospital costs (-25%)**	**Longer intervention (24.9 min)**	**Longer intervention & lower hospital costs**
Base case	€ 6340	€ 8020	€ 14880	€ 16556
Less effective (5.9% reduction)	€ 13766	€ 15375	€ 27091	€ 28723
Shorter effect (3 year rebound)	€ 22467	€ 24111	€ 41444	€ 43078
Less effective & shorter effect (5.9% reduction & 3 year rebound)	€ 39929	€ 41571	€ 70412	€ 72088

Next Consultation	**Base case**	**Lower hospital costs (-25%)**	**Longer intervention (24.9 min)**	**Longer intervention & lower hospital costs**
Base case	€ 5748	€ 7371	€ 13653	€ 15,78
Less effective (5.9% reduction)	€ 12768	€ 14396	€ 25219	€ 26848
Shorter effect (3 year rebound)	€ 21271	€ 22882	€ 39170	€ 40783
Less effective & shorter effect (5.9% reduction & 3 year rebound)	€ 36957	€ 38565	€ 64975	€ 66583

4.2.5 Sensitivity analyses - alternative implementation options

Table 4.6 presents the results of a range of alternative model runs, showing the estimated impact of using alternative screening tools and thresholds. These results show that whilst the current recommended screening tool in the Netherlands (AUDIT 8/5) is the most expensive to implement, it is also one of the most effective. The only alternative which provides a greater health benefit is AUDIT-C with a threshold of 5 of for men and 4 for women, which already included in guidance to Dutch GPs (NHG 2005). These results also illustrate the scale of potential net benefits from adopting a national SBI policy (estimated to be between €0.1-0.5bn at a willingness-to-pay threshold of €20000/QALY for any of the modelled scenarios).

Table 4.6 - Model results for alternative implementation scenarios, ordered by incremental net benefit

Setting	Screening tool and threshold (M/F)	Delivery costs (€m)	INHS Savings (€m)	Net cost to INHS (€m)	QALY gains ('000s)	Incremental net benefit versus do-nothing (€m)*
Registration	AUDIT 8	104	53	51	7.7	103
Registration	FAST 3	71	45	25	6.7	109
Registration	FAST 3 & AUDIT 8	73	46	27	7.3	119
Registration	Five-Shot	76	53	23	7.4	126
Registration	AUDIT 8/6	118	62	56	9.4	132
Registration	AUDIT 8/5	131	67	63	10.0	137
Registration	AUDIT-C 5/4	130	72	58	10.6	154
Consultation	AUDIT 8	315	172	143	27.5	407
Consultation	FAST 3	212	151	61	23.7	413
Consultation	FAST 3 & AUDIT 8	210	150	60	23.7	414
Consultation	AUDIT 8/6	359	194	165	30.5	445
Consultation	AUDIT 8/5	399	212	187	32.6	465
Consultation	Five-Shot	233	186	47	27.6	505
Consultation	AUDIT-C 5/4	397	230	167	34.6	525

Highlighted rows are baseline models

* Assuming a willingness-to-pay of €20000/QALY

4.3 Discussion

4.3.1 Summary of results

This adaptation of SAPM provides a robust analysis of the cost-effectiveness of screening and brief intervention programmes in the Netherlands, examining two implementation options: screening at the next registration with a new GP or screening at the next GP consultation. The outcome measures observed were the costs of screening, the reduction in costs to the Dutch healthcare system as a result of reduced morbidity and mortality and the improvement in health outcomes measured in QALYs. The resulting incremental cost-effectiveness ratios for all scenarios suggest that either of the modelled SBI programmes would be highly cost-effective when compared with a policy of no SBI, under current Dutch guidelines, with a policy of SBI at next consultation, using the current AUDIT-C 5/4 screening tool bringing the greatest net benefit of all modelled options (at a willingness-to-pay threshold of €20,000/QALY).

4.3.2 Limitations

The principal challenges to this analysis were those presented by the availability of Dutch data with which to adapt the existing model. Whilst every effort was made to obtain suitable data specific to the Dutch context this was not always possible, particularly with regards to healthcare costs, and assumptions regarding the similarities of the Dutch and English healthcare systems had to be made. The validity of these assumptions was discussed with the Italian collaborating partners to ensure that they were plausible and the uncertainty around key assumptions was tested using sensitivity analyses. There are a number of additional limitations which are common to all 3 of the model adaptations undertaken as part of WP3. These are discussed in Section 6.3.

4.3.3 Conclusions

These results demonstrate that a programme of SBIs in primary care in the Netherlands is very likely to be considered cost-effective, a conclusion which is fairly robust to more pessimistic assumptions around the costs and benefits of SBIs. Whilst these results provide a strong recommendation for the implementation of such programmes, policy makers should be mindful of the differing cost-implications of the alternative programmes. Whilst screening at next GP consultation brings the greatest health benefits and affects the largest number of people, it also carries a heavily front-loaded resource profile, whereas implementing a programme of screening at next GP registration offers a much more even spread of resourcing over the duration of the programme. These differences may have a major effect on the acceptability of different SBI programme options to policy makers attempting to balance limited health care budgets.

5. Polish Model

5.1 Methods

5.1.1 Background

There have been a number of trials in Poland of SBIs in hospital emergency department settings (e.g. Cherpitel et al. 2005; Cherpitel et al. 2009); however there has been little focus on their use in a primary care setting. There are no national guidelines and it is likely that current rates of SBI delivery in primary care are extremely low.

5.1.2 Modelled SBI policy

In the absence of national guidelines for SBI provision we followed the European guidelines formulated as part of the Primary Health Care European Project on Alcohol (PHEPA) project (Anderson et al. 2005). Accordingly screening is modelled using the AUDIT-C questionnaire with a score of at least 5 for men and 4 for women constituting a positive screen. Patients screening positively receive a 10 minute brief intervention. Both screening and intervention components are assumed to be delivered by a GP. In lines with Polish guidelines for economic evaluations all costs and health outcomes are discounted at 5% (Orlewska & Mierzejewski 2004) and all costs are presented in 2009 prices.

5.1.3 Consumption data

Consumption data for the Polish population was obtained from the Consumption Models 2008 survey (N=1075) (CBOS 2008) conducted by the Centre for Public Opinion Research (CBOS). This nationally representative survey records demographic data on each respondent as well as asking a series of questions about the frequency and usual consumption levels of beers, wines and spirits. Responses to the quantity questions were recorded in descriptive form (e.g. 2 large glasses of wine) and these were converted into standard portions in order to allow the mean weekly consumption in grams of alcohol to be calculated for each survey respondent. The survey also asks respondents how frequently they drink more than 1.5l of beer, 600ml of wine or 180ml of vodka in a single occasion. We used this as a measure of the risk of harm for health conditions associated with acute, rather than chronic, alcohol consumption, although less than 30% of respondents reported ever drinking above this level.

A comparison of the implied national mean consumption from the Consumption Models survey with estimates of mean consumption derived from alcohol sales data (Anderson et al. 2012) suggests that the survey responses account for only 24% of total alcohol consumption in Poland. The under-reporting of alcohol consumption in self-report surveys is widely acknowledged internationally (Knibbe & Bloomfield 2001; Stockwell et al. 2004); however the comparable coverage figures for England, Italy and the Netherlands are substantially higher at 57-60%. There are a number of possible explanations for this difference in under-reporting levels. Drinking patterns in Poland tend to be more polarised than in Western and Mediterranean Europe, with drinkers consuming large quantities of alcohol relatively infrequently (Popova et al. 2007). There is some evidence to suggest that quantity-frequency questions such as those used in the Consumption Models survey give lower mean consumption estimates in Poland than questions asking about an individual's last drinking occasion (Moskalewicz et al. 2011). This effect is not observed in the UK or Italy and may suggest that the use of questions focusing on 'usual' or 'typical' consumption are less accurate where drinking occasions are less frequent but heavier.

Another possible explanation may be the underrepresentation of heavy drinkers in national surveys. Whilst this issue has been identified in other countries (e.g. Meier et al. 2013), it may be that the sampling framework in Poland or the distribution of heavy drinkers in the population cause this to be a greater issue than in England, Italy or the Netherlands. Finally, Poland has undergone substantial political and cultural change over recent decades and there may be underlying cultural reasons which lead individuals to under-report their own consumption. The implications of this undercoverage on the modelling will be discussed in Section 5.3.2.

In an effort to explore the impact of some of these issues on the model results, alternative data was obtained from the National Alcohol and Drugs Survey 2010, which asked respondents similar questions to derive mean alcohol consumption and frequency of acute drinking. This survey benefits from a larger sample size (N=5107), slightly improved coverage of alcohol consumption (28%) and a higher nonzero response rate to the question about frequency of acute consumption (51%). This data is used in a sensitivity analysis to examine the uncertainty around the baseline consumption data used in the model.

5.1.4 Mortality and morbidity data

Absolute mortality data from 2009 for each of the 42 health conditions was obtained from the Central Statistical Office of Poland (GUS). Hospital admission data for each condition for 2009 was obtained from the National Institute of Public Health - National Institute of Hygiene (NIZP-PZH). In order to account for repeat admissions in the same year for the same individual, the estimated total number of admissions was divided by the adjustment coefficients, representing the mean number of admissions in a year for an individual with each health condition, presented in Appendix A.

5.1.5 Healthcare costs for alcohol-related morbidity

The model incorporates all healthcare costs to the Polish healthcare system for each health condition, including inpatient, outpatient and accident and emergency visits, ambulance costs, GP consultations, nurse visits and other costs. Whilst for Italy and the Netherlands we have used a 'bottom-up' costing approach, in which each cost aspect is valued for each health condition and summed to give the net annual cost of morbidity (Purshouse et al. 2013), this approach could not be taken in Poland as reimbursement tariffs are negotiated individually by each hospital and health care provider. However; data on the total annual cost of treating each of the 42 modelled health conditions was provided by the National Health Fund (NFZ), which allowed a 'top-down' approach to be taken. Reimbursement for primary care, first aid and sanitary transport and emergency medical services is made through either lump sum or capitation payments rather than on a service provided basis and the total costs for these aspects of treatments are therefore estimated by the NFZ rather than calculated directly. The total costs and total morbidities for 2009 were combined to give an estimated mean cost of treatment per annum for each health condition.

5.1.6 SBI delivery costs

The costs associated with implementing a screening and brief intervention programme were separated into the cost of briefing materials provided to the patient and the cost of the GP's time. The former were taken from a UK study by Lock et al. (Lock et al. 2006), converted into euros using OECD purchasing power parities (OECD 2013) and inflated to 2009 prices using the consumer prices index for Poland (www.inflation.eu 2013). The opportunity cost of the GPs time in delivering the SBI was estimated from an as-yet-unpublished 2010 GUS survey of salaries in health care. From this data the mean gross salary per minute was calculated for

each level of GP specialisation. This was weighted by the number of GPs at each level to give an estimated average cost of 0.63zł/minute.

5.1.7 SBI programme coverage

In order to estimate the population coverage of programmes of SBIs at next GP registration and next GP consultation it was necessary to estimate the proportion of each age-gender subgroup of the population who either register with or visit a GP in each of the 10 years of the modelled policy. Data from the NFZ shows that in 2011, 10.6% of the population changed their GP at least once (personal communication - NFZ 2013). Assuming the probability of registering with a new GP is independent from year to year allows the estimation of the number of people screened in each year of a 10 year programme. As population mobility varies substantially by age and gender (Kupiszewski et al. 1997), the age-gender pattern of new GP registrations observed in Italy was used, adjusting for the difference in population demographics between the two countries, to estimate the probability of being screened for each age-gender subgroup in the model over 10 years. An alternative assumption in which all age-gender subgroups share the same probability of changing GP each year was tested as a sensitivity analysis.

For screening at next GP consultation, data from the OECD shows that the average number of GP consultations per person in 2009 in Poland was 6.8 (OECD 2011). In order to estimate the proportion of each age-gender subgroup that would be captured by a programme of screening at next consultation it is necessary to understand the heterogeneity around this average and how this varies across the population. In the absence of any available data on this variation for Poland, existing data from Italy, which has a similar number of mean consultations per person, was used, adjusted for the slightly lower rate of consultations in Poland, to construct estimates for each age-gender subgroup. An alternative assumption in which all age-gender subgroups share the same probability of visiting their GP each year, taken from GUS figures showing that 73% of the population visited their GP in 2009, was tested as a sensitivity analysis.

5.1.8 Brief intervention properties

No published Poland-specific effectiveness studies for SBIs in primary care could be identified, therefore the central estimate of a reduction in consumption of 12.3% following a brief intervention, taken from the Cochrane review of Kaner et al. (2007), was used. This review found no significant relationship between duration of intervention and effectiveness; however a non-significant meta-regression estimated that a 10 minute intervention would lead to a reduction in mean alcohol consumption of 7.5%. This value is used in a sensitivity analysis, as well as the assumption that a 24.9 minute intervention (the mean duration of interventions in the Cochrane review) is required to achieve the 12.3% effect. In line with evidence from Fleming et al. (2002) any reduction in consumption is assumed to decay linearly over 7 years to the age-adjusted pre-intervention consumption level. A further sensitivity analysis is conducted in which this duration of effect is reduced to 3 years.

5.1.9 Sensitivity analyses and alternative assumptions

In order to investigate the impact of uncertainty around the baseline consumption data, the population coverage of the SBI programmes, the duration and magnitude of effect of the intervention on patients' drinking and the relationship between these and the duration of the brief intervention itself, we conducted a number of sensitivity analyses using more pessimistic assumptions for these parameters. Table 5.1 shows a breakdown of the alternative scenarios analysed for each of the two modelled SBI programmes.

Table 5.1 - Scenario analyses around key modelling parameters

Scenario	Consumption Data	Screening Coverage	Intervention Duration	BI Effectiveness	BI Duration of Effect
Baseline	Baseline data	Baseline profile	10 minutes	-12.3%	7 years
Alternative 1	Baseline data	Baseline profile	10 minutes	-7.5%	7 years
Alternative 2	Baseline data	Baseline profile	10 minutes	-12.3%	3 years
Alternative 3	Baseline data	Baseline profile	10 minutes	-7.5%	3 years
Alternative 4	Alternative data	Baseline profile	10 minutes	-12.3%	7 years
Alternative 5	Alternative data	Baseline profile	10 minutes	-7.5%	7 years
Alternative 6	Alternative data	Baseline profile	10 minutes	-12.3%	3 years
Alternative 7	Alternative data	Baseline profile	10 minutes	-7.5%	3 years
Alternative 8	Baseline data	Alternative profile	10 minutes	-12.3%	7 years
Alternative 9	Baseline data	Alternative profile	10 minutes	-7.5%	7 years
Alternative 10	Baseline data	Alternative profile	10 minutes	-12.3%	3 years
Alternative 11	Baseline data	Alternative profile	10 minutes	-7.5%	3 years
Alternative 12	Baseline data	Baseline profile	24.9 minutes	-12.3%	7 years
Alternative 13	Baseline data	Baseline profile	24.9 minutes	-7.5%	7 years
Alternative 14	Baseline data	Baseline profile	24.9 minutes	-12.3%	3 years
Alternative 15	Baseline data	Baseline profile	24.9 minutes	-7.5%	3 years

Scenario analysis is also used to examine the impact of alternative implementation options for an SBI policy, specifically the choice of screening instrument and threshold. The following alternatives were modelled to the AUDIT tool for each SBI programme to establish whether an alternative choice of screening tool may provide better results:

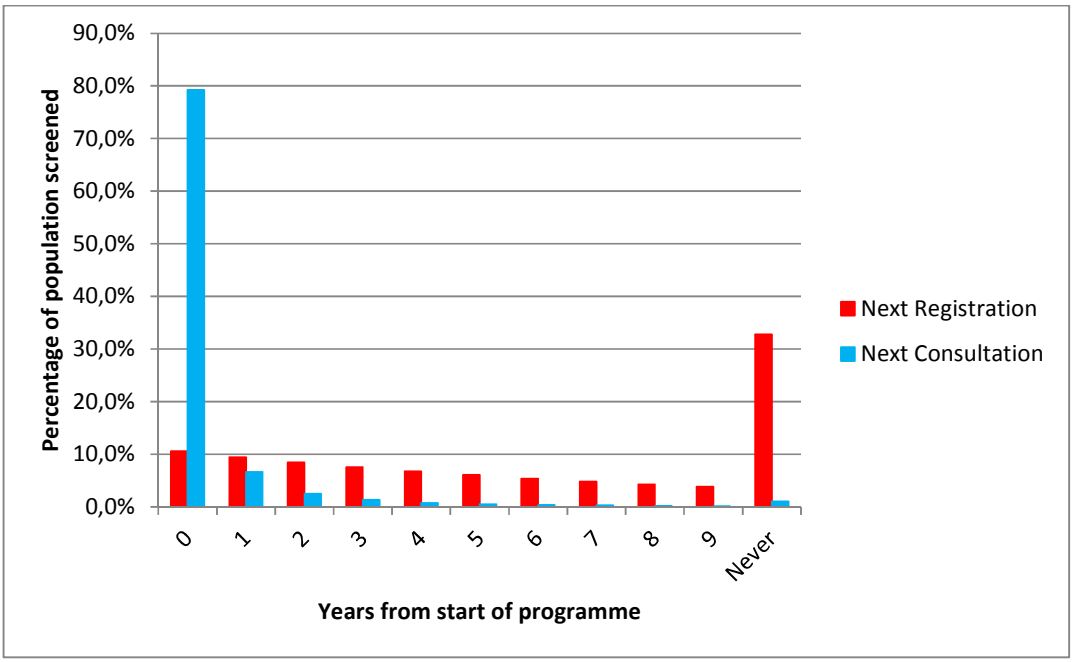
- AUDIT with a threshold of 8
- AUDIT with a split threshold of 8 for men and 6 for women
- FAST with a threshold of 3
- FAST with a threshold of 3 followed by the full AUDIT with a threshold of 8 for those screening positive on FAST

5.2 Results

5.2.1 Population coverage

The population coverage for a programme of screening at next GP registration is estimated to be 66% of the total adult population, leading to 20% of people receiving a brief intervention during the 10 years of the programme. Coverage is spread relatively evenly across the 10 years, steadily decreasing over time from the 10.6% screened in the first year. A programme of screening at next consultation is estimated to capture 99% of the population over 10 years, with 25% of adults receiving an intervention as a result; however this is heavily loaded towards the start of the programme, with 79% of people being screened in the first year. Figure 5.2 shows these coverage profiles over the lifetime of the programme.

Figure 5.2 - Population coverage of modelled screening programmes



5.2.2 Screening at next GP registration

Over the course of 30 years, a programme of screening at next GP registration is estimated to result in 2473 fewer alcohol-attributable deaths, predominantly from chronic (59%), rather than acute causes and with the overwhelming majority being amongst men (92%). The total number of hospitalisations saved by the programme is estimated to be 21517, with 48% of these for acute conditions and 86% among men. Table 5.3 gives a detailed breakdown of the estimated impact on alcohol-related morbidity in the fifth year of the programme

Figure 5.3 - Estimated reductions in morbidity (absolute and relative to baseline) in the 5th year of a programme of patients being screened at their next GP registration

	18-34 years				35-54 years				55+ years				Total					
	M		F		M		F		M		F		M		F		All	
Condition	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Road traffic accidents	-267	-2.9%	-17	-0.4%	-91	-1.9%	-3	-0.1%	-36	-1.0%	0	0.0%	-394	-2.3%	-19	-0.2%	-414	-1.5%
Alcoholic poisoning	-49	-1.6%	-21	-2.2%	-53	-1.1%	-6	-0.7%	-11	-0.5%	-5	-1.2%	-113	-1.1%	-32	-1.4%	-145	-1.2%
Alcoholic disorders	-53	-1.8%	-16	-3.2%	-122	-1.3%	-8	-0.4%	0	0.0%	-31	-2.4%	-176	-1.0%	-55	-1.4%	-230	-1.1%
Epilepsy	-46	-1.3%	-29	-1.1%	-43	-0.8%	-9	-0.4%	-19	-0.4%	-12	-0.4%	-108	-0.8%	-50	-0.6%	-158	-0.7%
Intentional self-harm	-13	-0.6%	-14	-0.8%	-8	-0.4%	-4	-0.3%	-1	-0.2%	-3	-0.4%	-22	-0.4%	-21	-0.5%	-43	-0.5%
Assault	-3	-0.4%	-1	-0.7%	-1	-0.3%	0	-0.2%	0	-0.1%	0	-0.4%	-4	-0.4%	-1	-0.5%	-5	-0.4%
Other accidents	-240	-0.4%	-77	-0.5%	-122	-0.3%	-25	-0.1%	-33	-0.1%	-69	-0.1%	-396	-0.3%	-170	-0.2%	-566	-0.3%
Diseases of the digestive system	-27	-0.6%	1	0.0%	-34	-0.2%	0	0.0%	-18	-0.1%	0	0.0%	-79	-0.2%	1	0.0%	-78	-0.1%
Diseases of the circulatory system	-35	-0.5%	-2	0.0%	-68	-0.1%	-1	0.0%	-85	0.0%	-4	0.0%	-188	-0.1%	-7	0.0%	-195	0.0%
Neoplasms	-1	-0.3%	0	0.0%	-5	-0.1%	-1	0.0%	-7	0.0%	-1	0.0%	-13	-0.1%	-2	0.0%	-15	0.0%
Other	0	-0.2%	0	0.0%	0	-0.1%	0	0.0%	0	-0.1%	0	0.0%	-1	-0.1%	0	0.0%	-1	0.0%
Diabetes	3	0.1%	1	0.0%	6	0.1%	0	0.0%	4	0.0%	1	0.0%	14	0.0%	2	0.0%	16	0.0%
Total	-731	-0.8%	-175	-0.3%	-542	-0.4%	-56	-0.1%	-207	-0.1%	-123	0.0%	-1,481	-0.3%	-354	-0.1%	-1,835	-0.2%

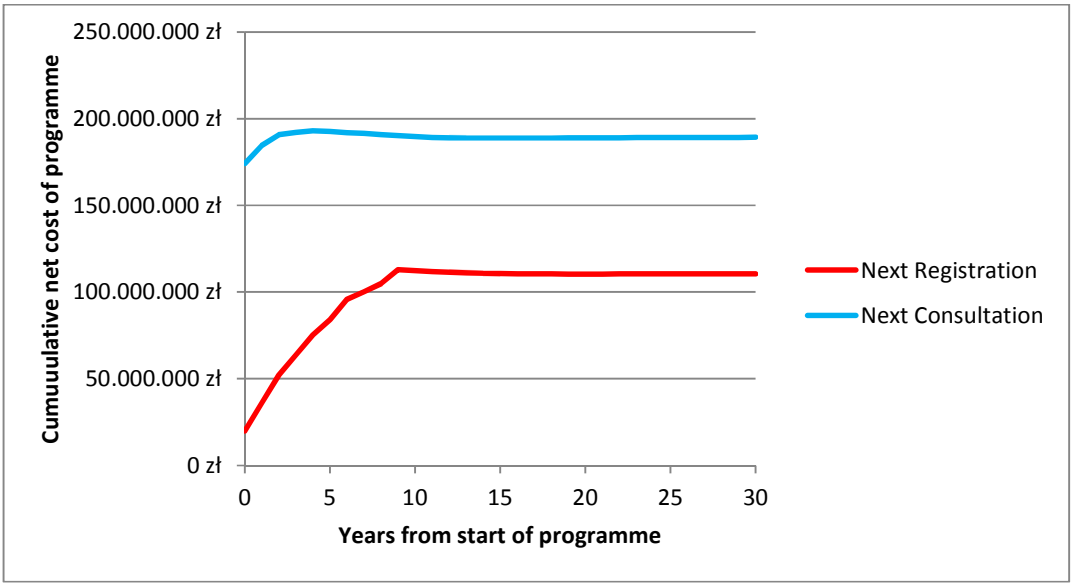
Included ICD-10 codes: (1) V0-V04, V06, V09-V80, V87, V89, V99; (2) T51.0, T51.1, T51.9, X45; (3) E24.4, R78.0, F10, G31.2, G62.1, G72.1, I42.6, K29.2, K70, K86.0; (4) G40-G41; (5) X60-X84, Y87.0; (6) X85-Y09, Y87.1; (7) W00-W19, W65-W74, X00-X49, V05, V07, V08, V81-V86, V88, V90-V98, W20-W64, W75-W99, X10-X39, X50-X59, Y40, Y86, Y88, Y89; (8) I85, K74, K80, K85, K86.1; (9) I10-I15, I20-I25, I47-I49, I60-I63; (10) C00-C15, C18-22, C32, C50; (11) L40 excl. L40.5, O03, Y35 (12) E10-E14

The cost of delivering SBIs over the 10 year programme is estimated to be 116 million zł. This is offset by a total reduction in hospital costs over 30 years of 5 million zł, giving a net programme cost of 111 million zł. The total gain in Quality-Adjusted Life Years (QALYs) is estimated to be 29900 giving an incremental cost per QALY gained (referred to as the Incremental Cost-Effectiveness Ratio (ICER)) of 3696zł/QALY. Most countries have some concept of the societal willingness-to-pay to 'purchase' an extra year of full health. In Poland this is estimated to be in the range of 12500-41000 zł (Orlewska & Mierzejewski 2004). The estimated programme cost is substantially below this threshold range, suggesting that such a programme would be considered highly cost-effective by Polish decision makers.

5.2.3 Screening at next GP consultation

As a programme of SBI at next GP consultation has wider coverage of the population, it is estimated to produce significantly greater improvements in public health, with 4915 fewer alcohol-attributable deaths, again, largely from chronic causes (61%) and amongst men (92%). The number of alcohol-related hospital admissions is also estimated to reduce by 37739 over 30 years, with the majority of this reduction amongst chronic causes (57%) and men (86%). The cost of delivering the SBI programme is higher, at 199 million zł, although this is offset against cumulative healthcare savings of 9 million zł, making the programme around 705 more expensive to implement than screening at next registration. Health savings are estimated to be 57900 additional QALYs, Giving an ICER of 3269 zł /QALY and suggesting there is little to choose between the two programmes in terms of cost-effectiveness. It should be noted that as the majority of SBIs take place in the first year of the programme, the bulk of the delivery costs are incurred up front, in contrast to screening at next registration, where the SBI costs are spread more evenly across the duration of the programme. Figure 5.4 shows the cumulative net costs of both programmes over time.

Figure 5.4 - Cumulative net costs of modelled screening programmes (implementation costs and cost savings to healthcare provider)



5.2.4 Sensitivity analyses - model assumptions

Table 5.5 presents the results of a range of sensitivity analysis conducted around a range of alternative modelling assumptions. These show that use of both an alternative source of consumption data and alternative assumptions about the frequency with which different

demographic groups change GPs have little impact on the cost-effectiveness results. Even pessimistic assumption such as a reduced effectiveness of SBIs, a reduced duration of effect for the intervention or a longer intervention being required to achieve the same effect have limited impact on the ICER and only under the most pessimistic combinations of assumptions does this exceed the minimum threshold of 12500 zł, and then only by a small margin.

Table 5.5 - Impact of pessimistic alternative assumptions for SBI delivery costs and effectiveness estimates: ICERs versus a 'do-nothing' scenario

Next Registration	**Base case**	**Alternative consumption data**	**Alternative screening coverage**	**Longer intervention (24.9 min)**
Base case	3696 zł	3261 zł	3390 zł	4649 zł
Less effective (7.5% reduction in consumption)	5984 zł	5357 zł	5474 zł	7500 zł
Shorter effect (3 year rebound to baseline consumption level)	8165 zł	7951 zł	7513 zł	10216 zł
Less effective & shorter effect (7.5% reduction in consumption & 3 year rebound to baseline consumption level)	13149 zł	12462 zł	12091 zł	16425 zł

Next Consultation	**Base case**	**Alternative consumption data**	**Alternative screening coverage**	**Longer intervention (24.9 min)**
Base case	3269 zł	2989 zł	3186 zł	4104 zł
Less effective (7.5% reduction in consumption)	5279 zł	4884 zł	5144 zł	6603 zł
Shorter effect (3 year rebound to baseline consumption level)	7281 zł	7279 zł	7125 zł	9090 zł
Less effective & shorter effect (7.5% reduction in consumption & 3 year rebound to baseline consumption level)	11661 zł	11438 zł	11386 zł	14542 zł

5.2.5 Sensitivity analyses - alternative implementation options

Table 5.6 presents the results of a range of alternative model runs, showing the estimated impact of using alternative screening tools and thresholds. These results show that whilst screening tools such as FAST and the full AUDIT questionnaire may be cheaper to implement, this reduction in costs comes with a corresponding reduction in expected health benefits. This provides good evidence to validate the use of AUDIT-C with a threshold of 5/4 in Poland, in line with PHEPA guidance (Anderson et al. 2005). These results also illustrate the scale of potential net benefits from adopting a national SBI policy (estimated to be between 0.6-1.7bn zł at a willingness-to-pay threshold of 25000 zł/QALY for any of the modelled scenarios).

Table 5.6 - Model results for alternative implementation scenarios, ordered by incremental net benefit

Setting	Screening tool and threshold (M/F)	Delivery costs (złm)	INHS Savings (złm)	Net cost to INHS (złm)	QALY gains ('000s)	Incremental net benefit versus do-nothing (złm)*
Registration	FAST-3/AUDIT 8	60	4	56	22.3	613
Registration	FAST-3	80	5	75	24.7	693
Registration	AUDIT 8	93	5	89	25.7	731
Registration	AUDIT 8/6	104	5	99	26.2	754
Registration	AUDIT-C 5/4	116	5	111	29.9	858
Consultation	FAST-3/AUDIT 8	111	7	104	46.3	1261
Consultation	FAST-3	136	7	129	45.3	1262
Consultation	AUDIT 8	141	8	134	47.6	1324
Consultation	AUDIT 8/6	164	8	156	48.6	1371
Consultation	AUDIT-C 5/4	199	9	189	57.9	1637

Highlighted rows are baseline models

* Assuming a willingness-to-pay of €20000/QALY

5.3 Discussion

5.3.1 Summary of results

This adaptation of SAPM provides a robust analysis of the cost-effectiveness of screening and brief intervention programmes in Poland, examining two implementation options: screening at the next registration with a new GP or screening at the next GP consultation. The outcome measures observed were the costs of screening, the reduction in costs to the Polish healthcare system as a result of reduced morbidity and mortality and the improvement in health outcomes measured in QALYs, in line with standard practice for economic evaluation. The resulting incremental cost-effectiveness ratios for all scenarios suggest that either of the modelled SBI programmes would be highly likely to be considered cost-effective when compared with a policy of no SBI, under current Polish guidelines, with a policy of SBI at next consultation, using the recommended AUDIT-C 5/4 screening tool bringing the greatest net benefit of all modelled options (at a willingness-to-pay threshold of 25000 zł/QALY).

5.3.2 Limitations

The principal limitations to this analysis are those arising from the availability of suitable Polish data with which to adapt several areas of the existing model. In particular there was a lack of available data on the frequency of GP registration and consultation, although sensitivity analyses suggest that this uncertainty is unlikely to substantively affect the conclusions of this paper. Another issue is that of accurate alcohol consumption data for the Polish population. Coverage rates from surveys vary widely between countries (Sierosławski et al. 2013) and the exact methods (Stockwell et al. 2004) used and undercoverage is a problem common to any attempt to model population alcohol consumption. The issue is somewhat mitigated in this study by the fact that the consumption-harm relationships for many of the health conditions are calibrated using the reported survey consumption, although this does not resolve the problem for these conditions if different subgroups of the population have differential rates of underreporting. For those health conditions for which these relationships are taken from the literature, issues may arise where the level of underreporting differs between the primary studies from which the relationship is derived and the population to whom it is applied. A number of approaches have been proposed to revise self-reported consumption data and attempt to account for this underreported consumption (Rehm et al. 2010; Meier et al. 2013; Boniface & Shelton 2013), however in light of the lack of evidence around differential rates of undercoverage in the Polish population these were not considered appropriate for the present study. It should also be noted any underestimation of both alcohol consumption and consumption-harm relationships is likely to increase the impact of an SBI policy, making the estimates presented here conservative. A number of additional limitations, which are common to all 3 of the model adaptations undertaken as part of WP3, are discussed in Section 7.

5.3.3 Conclusions

This study is evaluates the cost-effectiveness of two alternative programme of screening and brief interventions in primary care in the Poland. In common with other studies internationally the results demonstrate that such programmes are highly likely to be cost-effective, a conclusion which is robust to more pessimistic assumptions around the costs and benefits of SBIs. Whilst these results provide a strong recommendation for the implementation of such programmes, policy makers should be mindful of the differing cost-implications of the alternative programmes. Whilst screening at next GP consultation brings the greatest health benefits and affects the largest number of people, it also carries a heavily front-loaded resource profile, whereas implementing a programme of screening at next GP registration offers a more even spread of resourcing over the initial years of the programme. These

differences may have a major effect on the acceptability of different SBI programme options to policy makers attempting to balance limited health care budgets.

6. Discussion of model adaptations

6.1 Overview of results

The results from all 3 country adaptations of the SAPM suggest that SBIs in primary care are likely to be a cost-effective option, either when implemented at next GP registration or next GP consultation. Whilst the broad results are similar across all 3 countries, this similarity conceals a variety of differences in the estimated impact on the population health within each country. Figures 6.1 and 6.2 provide some illustration of these differences in terms of the distribution of health benefits for a programme of SBI at next registration each of the 3 modelled countries.

Figure 6.1 -Proportion of hospitalisations and deaths averted by health condition type

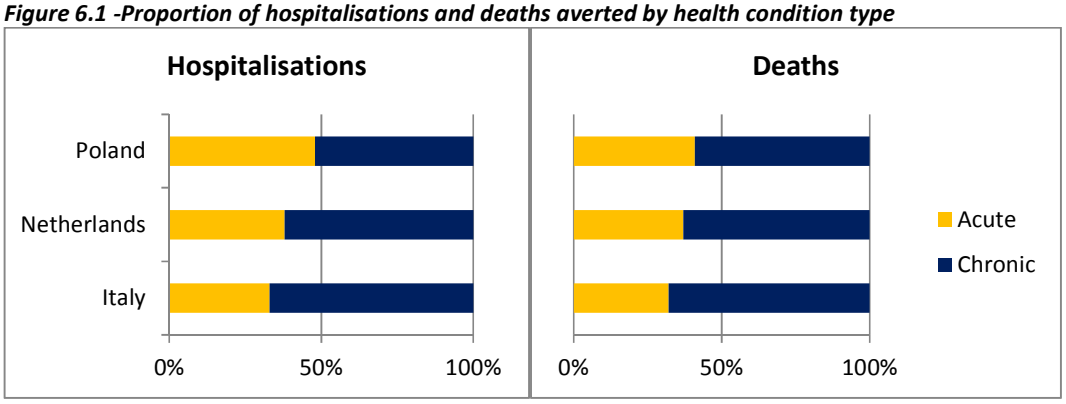
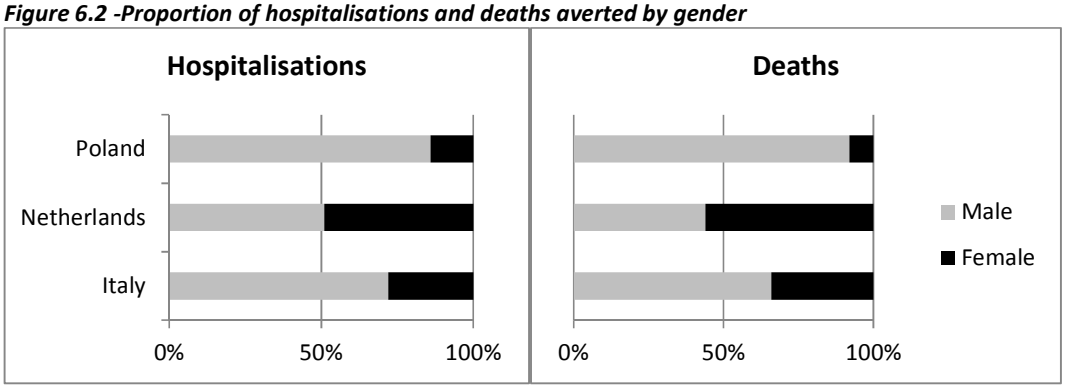


Figure 6.2 -Proportion of hospitalisations and deaths averted by gender



There are also significant differences in the scale of the costs and benefits associated with the modelled SBI programmes as well as the cost profiles. For example a programme of SBI at next GP consultation is estimated to cost approximately twice as much in the first year of implementation in Italy compared to the Netherlands, yet the cumulative cost over 30 years is less than half as much. These differences have important implications for decision makers and it is important that they are considered alongside the overall cost-effectiveness results.

6.2 Comparisons with existing literature

There are relatively few existing studies whose results can be used to draw comparisons to the results presented in Sections 3-5, particularly in a European setting. Only Purshouse et al. (2013) and Tariq et al. (2009) have previously estimated the long-term cost-effectiveness of opportunistic SBI programmes in primary care in Europe using a cost per QALY metric.

In Purshouse et al. the authors use the SAPM to model identical SBI programmes to the next registration and next consultation options appraised in this WP, in England. Although the underlying methodology is identical to the ODHIN models, the list of alcohol-related health conditions included in the model differs slightly. The authors estimate a next registration SBI programme to be both cost-saving (£120million over 30 years) and health-improving (32,000 QALYs gained over 30 years). A next consultation programme is also estimated to be cost-saving (£65million) and health-improving (76,000 QALYs gained).

Tariq et al. modelled the impact of a national programme of screening at next GP consultation with AUDIT and a threshold of 8 in the Netherlands. The authors modelled a 10-15 minute intervention with follow-up sessions at 6 and 12 months and estimated an ICER of €5400/QALY. The study differs from the current ODHIN models in that it includes only the health impact of reduced alcohol consumption on chronic health conditions which are wholly-attributable to alcohol (thus excluding conditions such as injuries and alcoholic liver disease) as well as including the future healthcare costs associated with non-alcohol-related diseases in additional years of life gained following the intervention (compared to the do-nothing scenario). Whilst this difference in perspective makes direct comparison of these results with the present study difficult, the conclusion that SBI programmes are highly cost-effective remains the same.

These studies, together with a handful of studies set in the United States (e.g. Fleming et al. 2002; Solberg et al. 2008) and the results produced as part of this WP provide a growing body of international evidence for the cost-effectiveness of SBIs in primary care.

6.3 Limitations

There are a number of limitations which are common to all 3 of the adapted country models presented in Sections 3-5. Whilst there are a large number of existing studies which have examined the effectiveness of brief interventions at reducing alcohol consumption, there is still limited evidence of their possible differential effectiveness in different patient populations (e.g. heavy drinkers), their long-term effectiveness or the relationship between the duration of an intervention and its effects. Issues of population heterogeneity are also likely to be a factor in the estimation of the population captured by the modelled SBI programmes, since frequency of GP registration or consultation is likely to vary by alcohol consumption and other factors such as socioeconomic status. The impact that these differences may have on the model results is unclear, since it depends on the complex interrelationship between the coverage of the SBI programme in the population and the distributions of alcohol consumption and alcohol-related harm.

A key limitation that must be borne in mind when interpreting the results of this WP is that the SBI programmes modelled assume 100% uptake amongst GPs (i.e. all GPs participate in the programme). Whilst this provides a strong indicator that partial uptake would still prove cost-effective, the relative cost-effectiveness across different uptake rates has not been examined. Furthermore the counterfactual against which the SBI policies are compared is a ‘do-nothing’ scenario in which no SBIs are delivered. The impact of this on the interpretation of the results for each of the 3 modelled countries depends in part on the current level of SBI provision being modelled, which, although varying between countries, is likely to be low at present. These assumptions are an area which will be explored further as part of the analysis of the WP5 trial results.

An additional limitation is the assumption in the model that all eligible patients are screened on their first visit to their GP, with a related issue being the assumption in the model that no patient receives more than one SBI over the 10 year policy implementation period. Although these assumptions may perhaps be unlikely in practice, the published evidence on the effect of repeated brief interventions on alcohol consumption is limited and it is possible that the benefits of such repeat interventions may outweigh the additional costs of their delivery. The issue of not all eligible patients being screened is something which we hope to investigate in the future using the results of the WP5 trial.

7. Generalisations on European Union transferability

7.1 Introduction

The second key objective of this WP is to consider the generalisability of the results presented in sections 3-5 to the rest of the European Union (EU). What implications, if any, do they have for policy makers in countries beyond Italy, the Netherlands and Poland? Whilst it may be tempting to compare the levels of alcohol consumption between countries and attempt to generalise on that basis, the results of Chisholm et al. (2004) suggest that this is unwise as countries with similar levels of mean alcohol consumption such as France and Poland (Anderson et al. 2012) are estimated to have widely differing cost-effectiveness results (I$7607/QALY versus I$604/QALY for an SBI programme when compared against current taxation). This signposts the need for a more appropriate means of applying the existing evidence to new countries in order to better inform alcohol policy decisions across the EU.

In order to be able to consider generalising these results to other contexts it is first necessary to investigate the relationships within each country model between the key model inputs and the model results. Experimental design, the process of optimising the design of repeated experiments (e.g. model runs) in order to maximise the value of the information which can be gained from their results (Law 2006), provides a framework for systematically examining these relationships. By identifying key model inputs and varying these across multiple values in accordance with the chosen experimental design, the impact of changes in each input value on the model results can be quantified, as well as the interactions between several input values.

Models such as the SAPM can often be complex and computationally expensive to run, which has led to the development of meta-modelling techniques. Meta-modelling involves the use of statistical regression in order to identify and estimate the relationship between the inputs and the outputs of the underlying model (Box & Draper 1987). This can then be used to construct a statistical 'meta-model' of the original model, which may be more parsimonious, easier to understand and considerably faster to run. Meta-models are usually constructed using experimental design methodology in order to ensure the robust estimation of the relationships between model inputs and outputs.

The present study aims to use experimental design to select an efficient series of model runs for the four country models (the 3 country adaptations described in sections 3-5 plus the original English model described in Purshouse et al. (2013)), the results of which can then be used to construct both individual meta-models for each country and a pooled meta-model. The individual meta-models will allow the estimation of the impact of a change in one or more key model parameters within each of the four modelled countries, whilst the pooled model will allow the estimation of cost and effectiveness estimates for SBI programmes in other countries where the key input factors are known or can be estimated.

7.2 Methods

7.2.1 Model standardisation

The first step in attempting to combine the results of the four country adaptations was to standardise the models to allow direct comparability of the results. All costs were converted to Euros using Purchasing Power Parities (OECD 2013) and inflated to 2013 prices using the country-specific harmonised inflation rate (www.inflation.eu 2013). It was also necessary to select a single SBI policy to model across all countries. In line with the guidelines produced by

PHEPA (Anderson et al. 2005) we modelled screening with AUDIT-C with a threshold of 5 for men and 4 for women, followed by a 10 minute brief intervention, with both the screening and brief intervention components delivered by a GP rather than a practice nurse. A programme of SBI at next GP registration was modelled as this is less resource-intensive than SBI at next GP consultation and may therefore present a more feasible option for countries in which there is currently no SBI provision.

7.2.2 Factor identification

To utilise experimental design to fit a generalised meta-model, the input parameters of the SAPM must be summarised into a number of key 'factors' or summary statistics. These factors must satisfy a number of criteria:

- The chosen factors should cover, as far as is possible, the key model inputs which may vary between countries
- As the experimental design process involves alternative levels of each factor, it must be possible to operationalise a percentage change in the factor into a change in the model inputs from which the factor itself is derived
- The factors must represent the same input data across all four models (i.e. they must be defined equivalently in all countries)
- The factor must have a significant effect on the model results (i.e. the model must be sensitive to changes in the factor's value)

In addition, since the final meta-model will be expressed in terms of these factors, it is important that they represent data which makes sense outwith the model. That is to say that they should be defined such that it is plausible to either calculate or estimate their values for other EU countries.

The number of factors which may be selected is a trade-off between coverage of the model inputs (as less factors will provide less information about the underlying data) and the scale of the fractional factorial design (as the number of model runs required rises dramatically with the number of factors). After careful consideration 6 factors were selected which fulfil the above criteria:

1. The mean alcohol consumption of the modelled population (in grams of pure alcohol/day)
2. The proportion of the modelled population screened over the 10 year programme
3. The per capita mortality rate from all alcohol-related health conditions combined
4. The per capita morbidity rate for all alcohol-related health conditions combined
5. The mean cost per hospitalisation for an alcohol-related health condition
6. The per-minute cost of the staff who deliver the SBI

The baseline level of these factors for each of the four countries is presented in Table 7.1.

Table 7.1 – Baseline factor values for modelled countries

Factor	England	Italy	Netherlands	Poland
Mean consumption (g/day)	15.6	12.2	12.8	7.0
Population screened	39.8%	69.8%	35.9%	67.2%
Mortality Rate (per capita)	0.00456	0.00404	0.00240	0.00439
Morbidity Rate (per capita)	0.0527	0.0327	0.0468	0.0319
Mean cost/hospitalisation (€)	7698	5854	8583	2810
GP cost (€/min)	3.85	0.96	3.01	0.28

7.2.3 Factor identification

Having identified the factors, the next step is to select an appropriate experimental design. One can view the factors as occupying a 6-dimensional decision space in which the aim of experimental design is to cover the widest possible range within this space, with the most efficient number of points. Each point in this space is referred to as a 'design point' and represents a single configuration of input factors for the model. The baseline values in Table 7.1 represent four design points, one for each country, and additional design points can be generated by varying these values across the decision space. Owing to the computational requirements of running the SAPM, each factor is varied across only two levels within each country. The implications of this decision will be discussed later. Two levels across six factors gives rise to 64 possible design points for each country, therefore a 2^{6-2} fractional factorial design (Law 2006) was selected to maintain the required number of model runs at a manageable level (16 per country). Fractional factorial designs sacrifice the ability to estimate higher-level interactions between factors in exchange for increased efficiency in terms of reducing the required number of design points.

The selection of the alternative levels (in addition to the baseline) for each factor, for each country, is a subjective process. The alternative values need to be sufficiently different from the baseline values to have a tangible impact on the model results, whilst also remaining plausible values for that factor within Europe. For some factors, most notably population coverage, the method of converting a change in the value of a factor to a change in the actual model inputs also places limitations on the possible alternative levels. Finally, the selection of alternative levels across all four models must aim to cover, as broadly as possible, the 6-dimensional decision space. In practice this is extremely challenging to achieve and a more pragmatic goal is to spread the levels for the four countries as evenly as possible across the 1-dimensional input space for each factor. The selected alternative levels (relative to baseline for each country) are given in Table 7.2.

Table 7.2 – Alternative factor levels selected for modelled countries

Factor	England	Italy	Netherlands	Poland
Mean consumption	-10%	+10%	+10%	+30%
% Population screened	+15%	-15%	+15%	-15%
Mortality Rate	-20%	-20%	+40%	-20%
Morbidity Rate	-20%	+20%	-20%	+20%
Mean cost/hospitalisation	-10%	+10%	-10%	+50%
GP cost	-50%	+100%	-50%	+100%

7.2.4 Meta-modelling

For each of the 64 design points (16x4 countries) the relevant country model was run to produce estimates of the incremental cost and QALY gain (versus do-nothing). These were

divided by the eligible population (i.e. people aged 18+) of each country in order to give per capita values which were comparable across all four models. In order to estimate the impact of the 6 factors on the modelled cost-effectiveness, separate Ordinary Least-Squares (OLS) regressions models were fitted for each country for both cost and QALY outputs.

OLS models for costs and QALYs were then fitted to all 64 design points and 2-level hierarchical variance component models were fitted to the pooled design points in order to examine the proportion of the variance in outputs attributable to differences between countries, rather than within-country factor differences. Selection of included independent variables for each model was undertaken using log-ratio tests and by comparing Bayesian Information Criteria (BIC) and adjusted R-squared values. All models were fitted and analysed using Stata 12 (StataCorp 2011).

7.3 Results

7.3.1 Country models

Baseline cost-effectiveness estimates for each modelled country are presented in Table 7.3, together with the ranges of outcomes across the 16 design points. These show considerable variation in both outcomes across the design points and between countries, although the baseline ICER estimates suggest that the modelled SBI programme would be considered cost-effective in all four countries under their current guidelines. Variation in costs for the Polish model is significantly less than the other three countries, which is likely to be a consequence of the low consumption levels, GP and hospital costs relative to the other three countries.

Table 7.3 – Within-country model results

		Per Capita Cost	Per Capita QALYs	ICER
England	**Baseline**	€5.29	0.00117	€4,533/QALY
	Range	-€1.94-€12.68	0.000579-0.00134	Dominates-€16,038/QALY
Italy	**Baseline**	€1.53	0.00135	€1,135/QALY
	Range	-€2.83-€7.07	0.000989-0.00179	Dominates-€6,032/QALY
Netherlands	**Baseline**	€-0.58	0.000876	Dominates
	Range	-€5.57-€2.45	0.000827-0.00110	Dominates-€2,702/QALY
Poland	**Baseline**	€1.69	0.00107	€1,584/QALY
	Range	€1.30-€2.22	0.000727-0.00142	€1,172-€2,435/QALY

Table 7.4 gives the coefficients from the final fitted OLS regression models for costs and QALYs for each country together with the adjusted R^2 values. It should be noted that as each factor takes only two values within each country, the models assume linearity and the high adjusted R^2 values are therefore indicative only of the coherence of the model within each country. As one would intuitively expect the signs of almost all coefficients are the same across all four countries. The one exception to this, the impact of mean consumption on costs in the Polish model, is likely to be a consequence of the differences outlined above, although it may suggest that the relationship between consumption and costs is non-linear. In general these models show that the per-person cost of SBI programmes is lower where consumption of alcohol, rates of alcohol-related illness and the costs of treatment are higher, while alcohol-related mortality and GP costs are lower and fewer people are captured by the programme. The QALYs gained from such programmes are higher where consumption, mortality and morbidity rates are higher and where more people are captured by the screening programme.

Table 7.4 – β-Coefficient estimates for within-country meta-models

	Costs				QALYs			
	England	Italy	Netherlands	Poland	England	Italy	Netherlands	Poland
Mean Consumption	-2.09**	-1.99**	-0.64**	0.06	0.00027**	0.00028**	0.00002**	0.00014**
% Population Screened	12.68**	4.50	-	3.64**	0.0025**	0.0023**	0.0020**	0.0020**
Mortality Rate Per Capita	-	-	392.88*	-	0.115**	0.198**	0.088**	0.183**
Morbidity Rate Per Capita	-191.39**	- 228.42**	-216.79**	-	0.0066**	0.0069**	0.0056**	0.0049*
Mean Cost/Hospitalisation	-0.0014**	- 0.0013**	-0.0011**	-	-	-	-	-
GP Cost	3.86**	4.90**	2.62**	1.50**	-	-	-	-
Constant	38.87**	33.56**	18.68**	-1.08**	-0.0050**	-0.0047**	-0.0006**	0.0049**
Adjusted R-Squared	0.9922	0.9777	0.9872	0.8026	0.9923	0.9730	0.9967	0.9899

*Significant at 95% level, **significant at 99% level

7.3.2 Pooled meta-models

After checking the consistency of the within-country models, all 64 design points were pooled and single meta-models estimated for both costs and QALYs. The final model results for costs and QALYs are presented in Tables 7.5 and 7.7 respectively, whilst Figures 7.6 and 7.8 present graphs illustrating the goodness-of-fit of both models. In view of the complex interrelationship of the input factors within the SAPM, plausible interaction terms between a number of these factors were tested but did not prove significant in either of the final models.

Table 7.5 – Final cost meta-model

Factor	Coefficient	Standard Error	p Value
% Population Screened	5.52	2.77	0.051
Mortality Rate Per Capita	1400.87	378.32	0.000
Morbidity Rate Per Capita	-102.59	44.66	0.025
Mean Cost/Hospitalisation	-0.00124	0.000207	0.000
GP Cost	3.918	0.286	0.000
Constant	-0.996	3.191	0.756
Adjusted R-Squared	0.7917		

Figure 7.6 – Cost model observed vs. predicted values

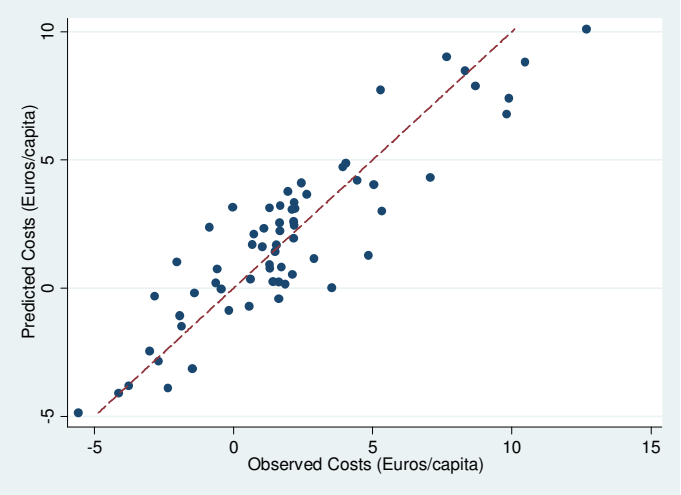
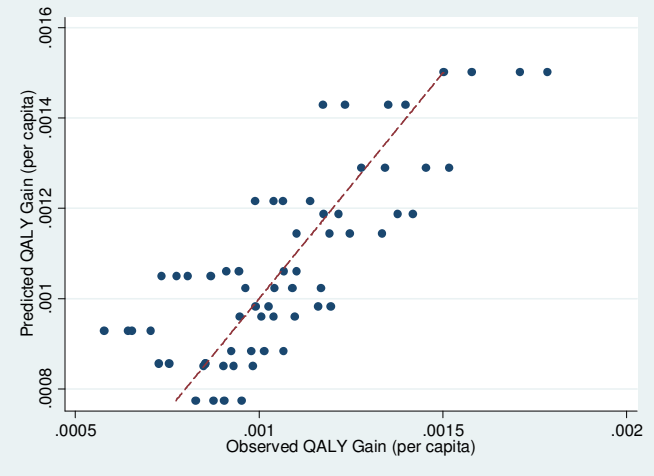


Table 7.7 – Final QALY meta-model

Factor	Coefficient	Standard Error	p Value
Mean Consumption	0.0000601	0.000009	0.000
% Population Screened	0.00203	0.000198	0.000
Constant	-0.000726	0.000191	0.000
Adjusted R-Squared	0.6236		

Figure 7.8 – QALY model observed vs. predicted values



All coefficients are significant at the 90% level, 6 out of 7 at the 95% level and 5 out of 7 at the 99% level. Adjusted R^2 values of 0.7917 and 0.6236 respectively suggest a good fit to the data, which is indicated by Figures 7.6 and 7.8. Note that as the generalised model is fitted across 6 values of each input parameter (two for each country), linearity is no longer assumed and the adjusted R-squared values can be interpreted as a true measure of model fit.

Results from the 2-level hierarchical variance component models show that 37% of the variance in costs and 38% of the variance in QALYs between the 64 design points arises from differences between the 4 countries. In an effort to explain some of this between-country variance, a number of additional country-specific factors, including life expectancy, median age, Gross Domestic Product (GDP) and abstention rate were tested in the pooled meta-models to see if they improved the model fit. None of these factors produced a significant improvement in model fit and therefore the final predictive models are those given in Equations 1 and 2. Figure 7.9 shows the relationship between the observed ICERs and those predicted using these models.

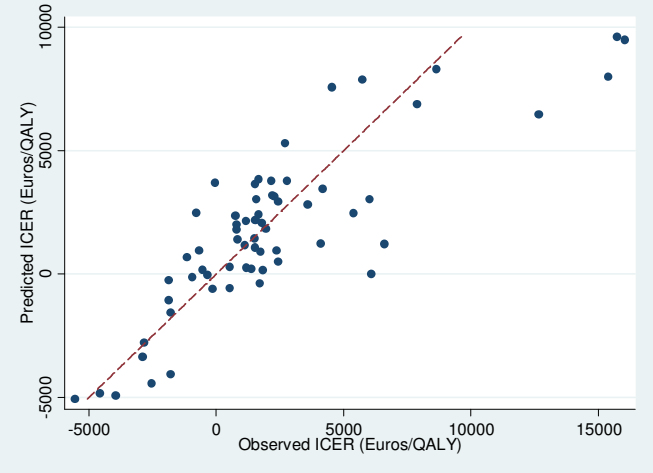
Equation 1 – Predictive equation for final cost meta-model

$$Per\ Capita\ Cost = 5.52 * Pop.Screened + 1401 * Mort.Rate - 103 * Morb.Rate + 3.92 * GP\ Cost - 0.996$$

Equation 2 – Predictive equation for final QALY meta-model

$$Per\ Capita\ QALYs = 0.0000601 * Mean\ Cons. + 0.00203 * Pop.Screened - 0.000726$$

Figure 7.9 – Observed vs. predicted ICERs for final meta-models



7.4 Discussion

7.4.1 Summary of results

The meta-model results confirm those of the individual country adaptations in showing that a programme of screening and brief interventions at next GP registration is highly cost-effective in England, Italy, the Netherlands and Poland. The individual and overall meta-models show consistently that implementing such a policy is more expensive in countries with higher alcohol-related mortality, where more people are captured by the programme and with lower alcohol-related morbidity rates. The health impact of an SBI policy is greater in countries where alcohol consumption is greater and where more people are screened.

7.4.2 Comparison to other studies

The only previous study which attempts to estimate the costs and effects of SBI programmes across Europe is the study by Chisholm et al. (2004) which reports per capita cost of SBI programmes in Europe ranging from €0.67-€4.75 and the per capita DALY gains ranging from 0.001024-0.002111. These ranges are similar to those given in Table 7.2, although it is should be noted that these correspond to the 64 design points, rather than estimates for the countries of the EU. The 3 regions into which Europe is partitioned by Chisholm et al. are defined on the basis of adult and child all-cause mortality rates, which are difficult to equate with the 5 factors included in the final meta-models. This makes it difficult to establish whether or not the results of the present study agree with the level of heterogeneity estimated by the Chisholm et al. paper, although both studies show that between-country heterogeneity does impact on both costs and health outcomes. A subsequent set of briefing notes published using the same cost-effectiveness model does make individual estimates for each EU country; however the authors model current taxation and SBIs as separate policies and estimating the incremental costs and effects of SBIs versus current taxations is not possible given the information published in the report (Chisholm et al. 2009).

7.4.3 Limitations

There are a large number of underlying assumptions and limitations which one must consider when interpreting the results of these meta-models. The factors selected for inclusion are summary statistics which can represent much more complex underlying data. A key example of this is around the pattern of drinking in the population. Whilst the models include mean consumption, additional factors describing the shape of this distribution may provide better

information, although they would be very difficult to operationalise as a change in the model inputs. Related to this is the fact that the models do not include any measure of heavy episodic or 'binge' drinking. Whilst the individual country models include such measures, they vary between countries, precluding their use in a generalised meta-modelling approach. In order for this analysis to be of value it is important that the factors selected cover a substantial proportion of the differences between countries. The variance-component models suggest that the chosen factors cover the variation in costs well, although they do not explain a third of the variance in both costs and QALY outcomes. It is unrealistic to expect perfect coverage, since some differences between the models cannot practically be captured by the input factors and the promising model fit statistics and figures provide support for the usefulness of the final models.

As mentioned in Section 7.2.3, the selection of the alternative level for each factor in each country involved a degree of subjectivity. Whilst every effort was made to ensure that the chosen levels provided adequate cover of the decision space, an alternative combination of levels may provide a better coverage and result in a better model fit. Another key limitation is the choice of experimental design and the restriction of each factor to only two levels within each country. Whilst the SAPM is linear in terms of some of the input factors (such as GP costs), it is non-linear to some degree in others. The use of additional levels and a fuller experimental design with additional design points would allow more complex regression model specifications to be tested which included non-linear factors and the interactions between factors. This would, however, significantly increase the number of model runs required and it is not clear that this would be justified by a substantially better fit for the final models as a result.

A final limitation which may affect the accuracy of the country models themselves is the issue of under-recording of alcohol consumption as discussed in Section 5.3. Population survey data is widely acknowledged to underestimate per capita consumption (Knibbe & Bloomfield 2001; Stockwell et al. 2004) and a comparison of the implied per capita consumption from the model input data within the four countries with aggregate national data based on sales and tax receipts (Anderson et al. 2012) suggests that coverage rates vary widely between Poland (24%) and the other three countries (57-60%). This difference will lead to the mortality and morbidity estimates for Poland for partially alcohol-attributable chronic conditions, where the consumption-risk relationships are taken from the literature, rather than calibrated to national data, being substantially lower than the other three countries. This may lead to the Polish model being less sensitive in terms of QALY outputs to changes in mean consumption.

The aim of this analysis is to allow the prediction of the costs and QALY impact of an SBI programme in other EU countries, using equations 1 and 2. It is important that the values used are as close as possible to the factors used in the fitting of the meta-models. The under-recording of consumption is again an issue here and it is important to note that inserting consumption estimates directly based on sales data or tax receipts will result in inaccurate estimates being made. Consumption estimates should instead ideally be taken from national surveys, although the issue of coverage described above is difficult to escape from. It is also important to consider the details of the modelled SBI programme and their relevance to the context of the country seeking to use the meta-models. Whilst every attempt has been made to ensure the scenario modelled is as widely applicable as possible, it may not be realistic under current practice and the prediction of a cost-per-QALY metric may be of limited relevance to policy-makers in some countries with different methods of health resource allocation. It should also be noted that the counterfactual scenario in all models is a 'do-nothing' option, where no patients receive SBI. This should be considered when applying the

model predictions to countries which already have some level of SBI provision, where the incremental costs and QALYs of the modelled SBI programme against current practice may be lower than the models suggest.

8. Conclusions and recommendations for policy/future research

8.1 Key findings

1. A programme of SBIs at next GP registration or next consultation is highly likely to be cost-effective in Italy

2. A programme of SBIs at next GP registration or next consultation is likely to be cost-effective in the Netherlands

3. A programme of SBIs at next GP registration or next consultation is highly likely to be cost-effective in Poland

4. Policy makers should be mindful of the budgetary impact over time of different SBI policy options

5. The use of AUDIT-C with a threshold of 5 for men and 4 for women is estimated to be the most cost-effective screening tool compared to the full AUDIT or FAST questionnaires across all 3 countries

6. SBI programmes are estimated to be more expensive in countries with higher alcohol-related mortality, where more people will be captured by the programme and with lower alcohol-related morbidity rates. The health impact of an SBI policy is estimated to be greater in countries where alcohol consumption is greater and where more people are screened.

8.2 Conclusions

The primary conclusions of this WP are that SBI programmes are highly likely to be cost-effective in Italy, the Netherlands and Poland and that policy-makers and healthcare practitioners in these countries should give serious consideration to their provision on a wider, national scale, whilst being mindful of the potential budgetary impacts. However, caution should be exercised in generalising these results to other countries as between-country differences can have a significant impact on the costs and benefits associated with the programme. The meta-model presented in Section 7 provides a framework to account for these differences and to allow decision makers across the EU to estimate the cost-effectiveness of SBI programmes in their countries.

8.3 Recommendations for future research

There are a number of areas for potential research which this WP highlights. A greater understanding of the long-term impact of brief interventions on individuals' drinking behaviour and how this varies across different subgroups of the population, would allow a more nuanced understanding of the impact of SBI programmes across the population as well as potentially enabling the design of targeted intervention programmes directed at those who stand to benefit the most. Further research into how different population groups within and between countries under-report their alcohol consumption would allow this issue to be better understood and accounted for in policy evaluations. There is also a need to explore the impact of partial rates of GP uptake of SBIs on cost-effectiveness results. Are there greater benefits in

increasing uptake from 0 to 10% than from 90-100%, for example? This is an area which the analysis of the WP5 trial results will seek to address. Finally there is considerable potential to expand and extend the meta-modelling framework introduced in Section 7, in terms of using the model presented here to estimate the impact of SBI programmes across the EU, but also to advance the methodological design of the meta-model and potentially extend its scope beyond the EU.

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10. Appendices

Appendix A - Alcohol-related health conditions

Figure 10.1 – List of alcohol-related health conditions included in the models

Health Condition	ICD-10 Code(s)	Adjustment Coefficient
Wholly Alcohol-Attributable Chronic Conditions		
Alcohol-induced pseudo-Cushing's syndrome	E24.4	1.17
Degeneration	G31.2	1.1
Alcoholic polyneuropathy	G62.1	1.14
Alcoholic myopathy	G72.1	1
Alcoholic cardiomyopathy	I42.6	1.26
Alcoholic gastritis	K29.2	1.09
Alcoholic liver disease	K70	1.51
Chronic pancreatitis	K86.0	1.47
Wholly Alcohol-Attributable Acute Conditions		
Excessive blood level of alcohol	R78.0	1
Mental and behavioural disorders due to use of alcohol	F10	1.14
Ethanol poisoning	T51.0	1.11
Methanol poisoning	T51.1	1
Toxic effect of alcohol, unspecified	T51.9	1.22
Accidental poisoning by exposure to alcohol	X45	1.03
Partially Alcohol-Attributable Chronic Conditions		
Malignant neoplasm of lip, oral cavity and pharynx	C00-C14	1.59
Malignant neoplasm of oesophagus	C15	2.19
Malignant neoplasm of colon and rectum	C18-21	2.14
Malignant neoplasm of liver and intrahepatic bile ducts	C22	1.59
Malignant neoplasm of larynx	C32	1.47
Malignant neoplasm of breast	C50	2.35
Diabetes mellitus (type II)	E10-E14	1.31
Epilepsy and status epilepticus	G40-G41	1.16
Hypertensive diseases	I10-I15	1.19
Ischaemic heart disease	I20-I25	1.19
Cardiac arrhythmias	I47-I49	1.27
Haemorrhagic stroke	I60-I62	1.07
Ischaemic stroke	I63	1.07
Oesophageal varices	I85	1.5
Unspecified liver disease	K74	1.32
Cholelithiasis	K80	1.16
Acute and chronic pancreatitis	K85, K86.1	1.1
Psoriasis	L40 excl. L40.5	5.74
Spontaneous abortion	O03	1.05
Partially Alcohol-Attributable Acute Conditions		
Motor Vehicle Accidents	V0-V04, V06, V09-V80, V87, V89, V99	1.05
Fall injuries	W00-W19	1.05
Drowning	W65-W74	1
Fire injuries	X00-X09	1.12
Accidental poisoning by exposure to noxious substances	X40-X49	1.03
Other Unintentional Injuries	V05, V07, V08, V81-V86, V88, V90-V98, W20-W64, W75-W99, X10-X39, X50-X59, Y40, Y86, Y88, Y89	1.06
Intentional self-harm	X60-X84, Y87.0	1.15
Assault	X85-Y09, Y87.1	1.04
Other Intentional Injuries	Y35	1.1

Appendix B - Estimation of adjustment coefficients

In order to link hospital admissions data with underlying population morbidity for each of the 42 health conditions included in the model we required the average number of hospital admissions per year for somebody with each condition.

Data was obtained from Dutch Hospital Data Foundation (DHD), consisting of all reported hospital attendances for 2010 in the Netherlands which included, amongst the diagnoses, one of the 42 alcohol-attributable conditions included in the model. The data covers 888,838 hospital admissions, with each one including the hospital ID no., a unique patient ID no., the patient's age and sex, the type of attendance (clinical or outpatient), the primary diagnosis and up to 17 subsidiary diagnoses. As the patient ID is assigned by the hospital there is no way of identifying patients who have attended multiple hospitals in the same year, however this was considered likely to be a sufficiently rare occurrence not to bias the results. 123,768 admissions (13.9%) are missing a patient ID no (i.e. repeat admissions cannot be identified) and these patients are excluded from the analysis, leaving a sample size of 765,070 admissions.

DHD collect data using ICD-9 codes, so these diagnoses were converted to ICD-10 codes using the equivalence given in Table 10.2 below. The ICD-9 code 577.1 doesn't distinguish between alcohol-induced chronic pancreatitis and non-alcohol-induced chronic pancreatitis, so the UK ratio of admissions for the two harms was used to apportion diagnoses coded 577.1 between the two (100% of male and 74% of female admissions were recorded as alcohol-induced).

The SAPM does not explicitly model co-morbidity, so it was therefore necessary to select a single health condition for each individual and retain only those admissions for that individual which related to that condition. This was done following the methodology of Jones et al. (2008) who performed similar calculations using English data. From this reduced dataset containing a single diagnosis and number of hospital admissions for each individual, the mean number of admissions for each condition could be calculated, which is exactly the adjustment coefficient used in the model. These coefficients are presented in table 10.1 in Appendix A.

Figure 10.2 - ICD-9 to ICD-10 code mapping

Diseases	ICD 10	ICD 9
Diseases wholly attributable to alcohol - Wholly attributable conditions		
Alcohol use Disorders	F10	291, 303
Alcoholic Polyneuropathy	G62.1	357.5
Alcoholic Cardiomyopathy	I42.6	425.5
Alcoholic Gastritis	K29.2	535.3
Alcoholic liver disease	K70	571.0-571.3
Excessive blood level of alcohol (Finding of alcohol in blood)	R78.0	790.3
Toxic Effect Of Alcohol-Ethanol	T51.0	980.0
Toxic Effect Of Alcohol-Methanol	T51.1	980.1
Toxic Effect Of Alcohol-Alcohol, unspecified	T51.9	980.9
Degeneration of nervous system due to alcohol	G31.2	331.7
Alcohol induced chronic pancreatitis	K86.0	577.1
Fetal alcohol syndrome	Q86.0	760.71
Intentional self poisoning by, and exposure to alcohol	X65	E860
Alcoholic myopathy	G72.1	359.4
Alcohol-induced pseudo-Cushing's syndrome	E24.4	255.0
Fetus and newborn affected by maternal use of alcohol	P04.3, O35.4	760.71
Diseases partially attributable to alcohol - Partially attributable chronic conditions		
Maternal and perinatal conditions		
Spontaneous abortion	O03	634
Low birth weight	P05-P07	656.5, 760, 765
Malignant neoplasms		
Mouth Malignant neoplasms of lip, oral cavity and pharynx	C00-C14	141, 143-146, 148, 149
Esophageal cancer	C15	150
Colon and rectal cancers	C18-C21	153-154
Malignant neoplasm of larynx	C32	161
Liver cancer	C22	155
Breast cancer	C50	174
Other neoplasms	D00-D48	210-239
Diabete mellitus	E10-E14	250
Neuropsychiatric conditions		
Epilepsy	G40-G41	345
Diseases of the Circulatory System		
Hypertensive heart disease	I10-I15	401-405
Ischemic heart disease	I20-I25	410-414
Cardiac arrhythmias	I47-I49	427
Oesophageal varices	I85	456.0-456.2
Haemorrhagic stroke	I60-I62	430-432
Ischemic Stroke	I63	433-437
Digestive diseases		
Cirrhosis of the liver	K74	571.5-571.9
Cholelithiasis	K80	574
Acute and chronic pancreatitis	K85, K86.1	577.0-577.1
Skin diseases		
Psoriasis	L40 excl. L40.5	696.0-696.2
Falls, homicide and suicide, and other injury - Partially attributable acute conditions		
Unintentional Injuries		
Road traffic injuries- pedestrian (Motor Vehicle Traffic)	V01-V04, V06, V09-V80, V87, V89, V99	E810-E819
Falls	W00-W19	E880-E888, E848
Accidental drowning and submersion	W65-W74	E910
Exposure to smoke, fire and flames	X00-X09	E890-E899
Accidental poisonings by exposure to noxious substances	X40-X49	E850-E858, E861-869
Other unintentional Injuries	V05, V07, V08, V81-V86, V88, V90-V98, W20-W64, W75-W99, X10-X39, X50-X59, Y40-Y86,Y88, Y89	E800-E849, E870-E879, E900-E909, E911-E929
Intentional Injuries		
Suicide and Self-inflicted Injuries	X60-X84, Y87.0	E950-E959
Homicide Assault	X85-Y09, Y87.1	E960-E969
Other Intentional injuries	Y35	E970-E978

Appendix C - Estimation of the next GP consultation 'arrival profile' for Italy

As no detailed data on the frequency of GP consultation by year for Italy could be identified it was necessary to estimate the coverage of a programme of SBI at next consultation. The average annual GP consultation frequency in 2008 was available for both Italy (Brignoli et al. 2010) and the UK (Hippisley-Cox & Vinogradova 2009), broken down by broad age-gender groups. As the consultation frequency amongst men aged 16-44 was almost identical in both countries, the arrival profiles were also assumed to be the same. For all other age-gender subgroups it was assumed that each individual has an underlying mean frequency of GP attendance per year, and that these frequencies are normally distributed, truncated below at 0 (as no patient can have a negative number of consultations). For each age-gender subgroup, 1,000 individuals were simulated from this distribution, with mean equal to the observed number of visits for the UK, using the NtRand (Numerical Technologies n.d.) add-in for Excel. For each individual it was assumed that their actual number of GP visits in a given year was Poisson distributed about their underlying mean and random draws were made from this distribution to estimate their consultation frequency in each of the 10 years of the SBI programme. This allowed an implied arrival profile to be generated from the simulated individuals, which was compared to the observed profile for the age-gender subgroup taken from the English model (Purshouse et al. 2009). The standard deviation of the truncated normal distribution was then varied in order to identify the value which provided the closest match between the implied and observed profiles. Model fit was compared using root mean squared error between the observed and estimated arrival profiles for each subgroup

Having identified the standard deviation which gave the best fit, this was assumed to be the same between the UK and Italy, and the simulation was repeated for Italy using the observed number of visits reported in Brignoli et al. (2010), to generate an estimated arrival profile for that age-gender subgroup. This exercise was repeated to construct a complete profile for the entire population. In order to test the validity of this truncated normal-Poisson specification a range of alternative distributional assumptions were tested, including Poisson-Poisson, negative binomial, exponential, lognormal and lognormal-Poisson, however these did not give a satisfactory fit to the observed English arrival profile data.