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Cost-effectiveness of possible future smoking cessation strategies in Hungary: results from the EQUIPTMOD

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Running head: CE analysis of smoking cessation in Hungary

Author contribution: All authors conceived the study. BN conducted the analysis with support from JHJ, ZV and SP. The accuracy of the analysis was checked by TD, AK, TK, MH, KLC, KC and ALG. BN and JHJ wrote the first draft which was commented on by all authors. SP contributed substantially to the revision of the earlier drafts. All authors have read and approved the final manuscript. This analysis is a part of the European-study on Quantifying Utility of Investment in Protection from Tobacco (EQUIPT) of which SP is the Lead Investigator, ZV is the Hungarian Country Lead.

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Keywords: Smoking Cessation, economic model, return-on-investment tool, Hungary

ABSTRACT

AIMS

To evaluate potential health and economic returns from implementing smoking cessation interventions in Hungary.

METHODS

The EQUIPTMOD, a Markov-based economic model was used to assess the cost-effectiveness of three implementation scenarios: (a) introducing a social marketing campaign; (b) doubling the reach of existing group-based behavioral support therapies and pro-active telephone support; and (c) a combination of the two scenarios. All three scenarios were compared with the current practice. The scenarios were chosen as feasible options available for Hungary based on the outcome of interviews with local stakeholders. Lifetime costs and quality-adjusted life years (QALYs) were calculated from a healthcare perspective. The analyses used various return on investment (ROI) estimates, including incremental cost-effectiveness ratios (ICERs), to compare the scenarios. Probabilistic sensitivity analyses assessed the extent to which the estimated mean ICERs were sensitive to the model input values.

RESULTS

Introducing a social marketing campaign resulted in an increase of 30 additional quitters per 100,000 smokers, translating to healthcare cost-savings of €0.65 per smoker compared with the current practice. When the value of QALY gains was considered, cost-savings increased to €14 per smoker. Doubling the reach of existing group-based behavioral support therapies and pro-active telephone support resulted in healthcare savings of €0.25 per smoker (€3.96 with the value of QALY gains), compared with the current practice. The respective figures for the combined scenario were: €0.90 and €18. Results were sensitive to model input values.

CONCLUSIONS

According to the EQUIPTMOD modelling tool it would be cost-effective for the Hungarian authorities introduce a social marketing campaign and double the reach of existing group-based behavioural support therapies and pro-active telephone support. Such policies would more than pay for themselves in the long run.

INTRODUCTION

Tobacco use is considered to be the most preventable cause of deaths and diseases that can be dealt with comprehensive and evidence-based control policies (1). Tobacco consumption is a proven risk factor of various diseases (2). Age- and multivariable-adjusted relative risk of death from different smoking-related diseases is significantly higher among current smokers compared to non-smokers (3).

Smoking constitutes a major societal burden worldwide as well as in Hungary. According to the GLOBOCAN project of the International Agency for Research on Cancer, Hungary was leading in both incidence and mortality from lung cancer in 2012 (4). Based on data provided by the Hungarian Central Statistical Office, the total number of deaths from lung cancer was close to 9,000 in 2012 (5) in the country, while death from all causes associated with smoking was 20,470 in 2010 (6). These high numbers are strongly correlated with the high prevalence of smoking in Hungary - 33.4% among males and 22.2% among females (5). This high prevalence underlines the necessity of smoking cessation interventions.

In order to decrease smoking-related deaths and diseases, and to improve public health outcomes, both smoking prevention and incentives for smoking cessation are essential instruments (7, 8, 9). There are several smoking cessation interventions available globally; however, Central and Eastern European (CEE) countries like Hungary have strict budgetary constraints in various areas of healthcare (10) including smoking cessation programs. In order to utilize the scarce resources in the best possible way, decision makers need robust information on the costs and potential benefits of implementing different tobacco cessation interventions. As various interventions differ in their cost-effectiveness, resource allocation decisions have to be based on return on investment results of the available programs (11).

Hungarian stakeholders (decision makers, service purchasers, academics, researchers and health advocates) see several interventions having potential to address the issue of tobacco consumption in the country (12). These include indoor smoking ban in public places, taxation of tobacco products, brief physician advice, single form nicotine replacement therapy, standard duration varenicline therapy, one-to-one and group-based specialist behavioral support therapies and the use of printed self-help materials. These interventions are shown to be effective and cost-effective elsewhere (13). There are also other interventions currently in place in Hungary such as combined health warnings with pictures on packaging of tobacco products. In Voko et al. study, the Hungarian stakeholders expressed needs for further improvement of current practice, both by introducing new evidence-based interventions, for example social marketing campaigns, and by improving the reach of interventions that are already in place in Hungary.

The European-study on Quantifying Utility of Investment in Protection from Tobacco (EQUIPT) aimed to transfer an existing return-on-investment (ROI) model developed by the National Institute for Health and Care Excellence (NICE) in England (14) to other European Union member states. The model (EQUIPTMOD) is able to provide various return-on-investment estimates when implementing a comprehensive package of tobacco-control interventions to help decision makers in optimal resource allocation decisions (13).

The primary goal of the current study was therefore to use the EQUIPTMOD to evaluate the cost-effectiveness of implementing three prospective investment scenarios in Hungary. The prospective scenarios included in this analysis are feasible options available for tobacco control in Hungary based on the outcomes of interviews with local stakeholders. The first scenario involved introducing a country-wide social marketing campaign; the second scenario consisted of doubling the reach of group-based behavioral support therapies and pro-active telephone support; and the third included the combination of both. This study evaluated the prospective scenarios compared with the current practice.

METHODS

The EQUIPT model

The EQUIPTMOD is a Markov-based state-transition model that was developed in Microsoft Excel to evaluate various polices regarding tobacco control and smoking cessation interventions and it has been described elsewhere in more detail (15). Markov models are used in health economics to model the changes in patients' health states over time (16, 17). Markov models place patients into discrete and mutually exclusive health states. The EQUIPTMOD uses three Markov states: current smokers (both daily and occasional smokers), former smokers and death.

As interventions are implemented, the smokers who are assumed to make a quit attempt in the subsequent 12 months may stop smoking. In subsequent cycles of the model, the balance of some former smokers relapsing and some current smokers quitting is reflected by the background quit rate. Over time, individuals in the cohort may develop smoking-related diseases (coronary heart diseases, chronic obstructive pulmonary disease, stroke and lung cancer). They are also subject to higher age- and gender-specific mortality compared to non-smokers, because their risks are also affected by their smoking habits. Each cycle is one year long, and the model calculates the utility values (based on EQ-5D mean scores), costs of interventions and costs of the treatment of smoking attributable diseases. Additionally, the model calculates population weighted average costs and QALYs (quality-adjusted life years). Costs and outcomes are calculated per cycle then summed and discounted by the pre-defined discount rate (3.7%) at various time horizons, i.e. 2 years, 5 years, 10 years and a lifetime (max age 100 years). The EQUIPTMOD provides estimates of costs and benefits of various smoking cessation interventions and allows comparisons between various investment scenarios. There are three main investment scenarios available in EQUIPTMOD:

(a) Zero Investment Scenario (or the baseline) represents the theoretical gross cost of tobacco use if all ongoing financial investment in interventions and policies were immediately cut. This baseline scenario provides a benchmark against which to compare the impact of current and prospective interventions.

(b) Current Investment Scenario (or current practice) represents the estimated amount of money that is actively being spent on tobacco control interventions (including smoking cessation services) this year. One can thus compare the delivery of the current level of investment to the Zero Investment Scenario to determine the ROI of the current practice.

(c) Prospective Investment Scenario represents the potential future level of funding required to deliver interventions when user-defined changes are made to the current practice. This new collection of interventions is referred to as the "prospective scenario" and this scenario allows one to determine the potential ROI of making amendments to the current provision of services.

Selection of scenarios

We selected the following scenarios for the purpose of this analysis:

Current practice in Hungary: The current practice in Hungary included - existing legislation that bans indoor smoking; current levels of tobacco taxation; brief physician advice; standard duration varenicline; over-the-counter (OTC) nicotine replacement monotherapy; one-to-one and group-based specialist behavioural support; pro-active telephone support; and the use of printed self-help materials. The current practice is the primary comparator in this analysis.

Prospective scenarios: Hungarian stakeholders that we consulted as part of the EQUIPT study considered two prospective scenarios that could complement the current practice in Hungary and are feasible to implement. The first scenario included introducing a country-wide social marketing campaign with a proposed reach of 100% and a per capita cost of 0.48 Euros in addition to the current practice (Table 2). In Hungary, the recent country-wide social marketing campaigns targeted the entire population with the intention of changing public opinion and raising awareness for problems in the form of radio and television public service announcements and social issue advertisements. This (Prospective scenario 1) was therefore planned to be designed on the basis of these social marketing campaigns. The relative increase in quit attempts is the measure of effectiveness of interventions included in the EQUIPT-model, and we used the value for this model input from an English population-based cross-sectional study (18).

Another feasible option (Prospective scenario 2) was a scenario in which the reach of group-based behavioral support therapies and pro-active telephone support were doubled from the currently observed rates of 0.20% and 0.19% of all smokers respectively (Table 2) while leaving the costs and reach of all other interventions unchanged. Feasibility of doubling the reach of pro-active telephone support depends on the healthcare system's ability to increase resources (including human resources) to deliver this. Stakeholders agreed that adequate amount of relevant workforce is available in Hungary; therefore only additional monetary resources will be required - the level of which was considered to fall within a feasible range. Besides, the practicalities around this scenario were assumed to be fairly simple.

The third option (Prospective scenario 3) combined both scenarios discussed above as this was considered feasible and in practical terms, Prospective scenario 1 is likely to support Prospective Scenario 2.

As it was important to consider theoretical gross cost of tobacco use as the counterfactual against which to compare the impact of current and prospective interventions, the baseline was also included as a secondary comparator. The baseline consisted of no interventions (zero investment scenario), except existing indoor smoking ban and current levels of tobacco taxation. In practical terms, it was impossible to exclude these two interventions from the baseline (see Coyle et al. 2017 (15) for a discussion about this).

ROI estimates

The model provides a total of 18 estimates. The majority of the ROI estimates are expressed as an average per smoker. Estimates like the additional number of quitters and avoided burden of disease (i.e. the number of QALYs gained) are expressed on per 1,000 smokers or across all smokers in a particular country.

Incremental cost-effectiveness ratios (ICER) are estimated for both life years gained and QALYs gained. To calculate the ICER, the incremental costs of intervention per smoker were divided by the incremental life years or QALYs gained per smoker; the value was compared to the Hungarian willingness-to-pay threshold to decide on the cost-effectiveness of the prospective scenario compared to the current practice.

Other ROI estimates include: the value of productivity gains due to reduction in absenteeism and the healthcare cost-savings due to reduction in passive smoking attributable diseases (lower respiratory infections, otitis media and asthma in children; and asthma, lung cancer and CHD in adults) (19).

Cost-savings divided by the cost of implementing the scenario yields a Benefit-Cost ratio. A ratio of 2.1, for example, suggests that for every €1 invested, one could expect a return of €2.10. Two types of Benefit-Cost ratios are estimated- one with just healthcare savings and the other with healthcare savings plus the monetary value of QALY gains. The monetary value of healthcare gains is the product of number of QALY gains and willingness-to-pay threshold. Although there are various methods to convert QALYs to monetary values (20), we used the willingness-to-pay approach (21, 22) despite some important limitations of this method (23, 24). Calculating monetary value of QALY gains in this way enables the estimation of Benefit-Cost ratios. Benefit-Cost ratios are easy to understand and interpret.

Model Input Data

A number of model input data was required to conduct this analysis. As the analysis took lifetime perspective, a discount rate of 3.7% for both costs and health gains was used in line with the current recommendation of the Hungarian Pharmacoeconomic Guideline (25). Input values were gathered from Hungary, where available, and where unavailable, we used the input values from England or other countries after rigorously considering their relevance to Hungary.

The data on relative effectiveness of interventions were gathered from the scientific literature. Reach values were gathered from expert interviews while intervention cost values were based on expert interviews and databases of the Hungarian National Institute of Health Insurance Fund Management. These input values are presented in details in Table 1. In addition, the Hungarian Appendix of the EQUIPTMOD Technical Manual provides details of all other input values and their sources (26).

All costs were converted to Euros (€) using a 310 HUF/€ exchange rate based on the average conversion rate of 2015 obtained from statistics of the European Central Bank (27). According to the Hungarian technical guideline for making health-economic analyses published by the Ministry of Human Resources (25), if the ICER is under the lower cost-effectiveness threshold that equals to two times the Hungarian GDP per capita, the prospective intervention is considered cost-effective. If the ICER is above the higher willingness-to-pay threshold that equals to three times the Hungarian GDP per capita, the examined alternative intervention is not cost-effective. In our analysis, the upper Hungarian threshold is used which was calculated as €31,563.08/QALY based on the data provided by the Hungarian Central Statistical Office (28). This willingness-to-pay threshold was used to convert a QALY gain to monetary values before calculating benefit-cost ratios.

Sensitivity analysis

A probabilistic sensitivity analysis (PSA) was conducted to assess the uncertainty around ROI estimates. These analyses were limited to the first two scenarios only and the 'baseline' as the comparator (see discussion section for PSA limitations). The PSA was performed with 1000 model runs to produce distributions of expected costs and outcomes (QALYs). All model inputs were included in the probabilistic sensitivity analysis. During the PSA, beta distributions were used to provide stochastic values for utility (quality of life) and reach of interventions; gamma distributions for costs; and lognormal distributions for relative risks. The results of the PSA are presented as cost-effectiveness planes and cost-effectiveness acceptability curves.

RESULTS

ROI of current practice

An average of €9,914 per smoker is being spent on the treatment of smoking-related diseases currently in Hungary. The current provision of smoking cessation interventions costs €8.33 per smoker to the healthcare system. However, this provision also generates 10.33 quitters per 1,000 smokers, and results in 12.64 QALYs (Quality-Adjusted Life Years) per smoker over the lifetime horizon. Compared to the baseline, every €1 spent on the current provision would generate €4.55 over the lifetime horizon if the monetary value of QALY gains were considered in the return on investment calculation.

ROI of Prospective scenarios

The detailed results for all 18 ROI estimates are presented in Tables 3-5.

The prospective scenario 1 (introducing a social marketing campaign) is dominant (i.e. cost-saving: less expensive to run but provides more health benefits) compared to the current practice on a lifetime horizon. Every €1 invested in the Prospective scenario 1 would generate €20.80 over the lifetime horizon if the monetary value of QALY gains is considered (Table 3).

Likewise, the Prospective scenario 2 (doubling the reach of selected interventions) is also dominant compared to the current practice. Every €1 invested in the Prospective scenario 2 would generate €33.84 over the lifetime horizon if the monetary value of QALY gains is considered (Table 4).

The more ambitious combined option, Prospective scenario 3, also results in more QALY gains, together with reduction in total costs, compared with the current practice. This scenario is therefore dominant but the number of quitters and the amount of cost-savings are higher than that in the case of scenarios 2 and 3 (Table 5).

All prospective scenarios result in less average costs per smoker, while more QALYs and life years are gained among all smokers. All prospective scenarios reduce smoking-related productivity loss and the costs associated with passive smoking of children and adults as well (Tables 3-5).

Sensitivity of ROI estimates

The results of the PSAs indicated that introducing a country-wide social marketing campaign resulted in more QALYs per smoker in 89.4% of all cases, while in 7.8% of all cases, cost savings were observed, compared with the baseline. The social marketing campaign remained a dominant alternative compared to the baseline in 7.8% of the model runs. The Prospective scenario 1 produced more QALYs with more investment (costs) but still had an ICER below the Hungarian willingness-to-pay threshold of €31,563.08/QALY in 53.8% of all cases, presenting it as a cost-effective alternative scenario compared to the baseline in a total of 61.6% of all model runs. The scatter plot diagram of this sensitivity analysis is presented in Figure 1.

Doubling the reach of the group-based specialist behavioral support therapy and pro-active telephone support programs (Prospective scenario 2) resulted in more QALYs per smoker in 89.8% of all cases, while in 5.8% of all cases, costs savings were observed, compared with the baseline. Therefore, this scenario remained a dominant alternative compared to the baseline in 5.8% of the model runs. This scenario produced more QALYs with more investment (costs) but still had an ICER below the Hungarian willingness-to-pay threshold in 60.2% of all cases, making it a cost-effective alternative investment package compared to the baseline in a total of 66.0% of all model runs. The scatter plot diagram of this sensitivity analysis is presented in Figure 2.

The cost effectiveness acceptability curves (CEAC) are presented for both prospective scenarios in Figure 3. There are only minor differences between the two curves, as the CEAC of the Prospective scenario 2 is slightly above the one calculated for the Prospective scenario 1. At a willingness-to-pay (WTP) threshold of €30,000/QALY, the probability of being cost effective is 61% for the scenario 1 and 65.6% for the scenario 2. The Prospective scenario 1 has a 50% probability of being cost-effective at a threshold value of €18,900/QALY, while the Prospective scenario 2 has a 50% probability of being cost-effective at a threshold value of €16,300/QALY. Both of these values are lower than the Hungarian willingness-to-pay threshold of €31,563.08/QALY.

DISCUSSION

This study shows that introducing a country-wide social marketing campaign and expanding the reach of group-based specialist behavioral support therapy and pro-active telephone support programs could provide more health gains to current smokers than the current provision alone and could result in a decrease in smoking-related healthcare costs. Both strategies implemented together could be a feasible and cost-effective policy option currently available to decision makers in Hungary.

The intervention effect of social marketing campaign is small (a relative effect of 1.03) but given their reach, we would expect higher number of current smokers making quit attempts compared to the current practice (3% more). In the case of this intervention, given the relatively small size of the benefit achieved, the proper implementation and financial management are crucial. Or else, the benefits could easily be lost by poor implementation / financial management. On the other hand, albeit the group-based specialist behavioral support therapy and pro-active telephone support programs have higher relative effects (2 and 1.4 respectively), given their low reach (0.41% and 0.38%) among the current smokers, we would expect only a few more current smokers succeeding in their quit attempts. Therefore, the results of the proposed changes are going to have marginal effects on the entire smoking population, but are considered to have reasonable impact on the number of quit successes in the groups of smokers that will be reached by these interventions. Our analysis also showed that better ROIs would be gained by combining the two options. It makes sense to combine the two as the first scenario is likely to support the second scenario to produce larger benefits.

Whilst our analysis provides the health and economic value of alternative strategies to complement the current provision of smoking cessation in Hungary, the sensitivity analysis could establish their cost-effectiveness to some extent only. Using the Hungarian willingness-to-pay threshold, the probability of the first two scenarios being cost-effective is about 2 in 3. However, it is important to put this uncertainty in to perspective and consider the significant health gains that these strategies would generate over time, compared to the current provision of services..

This analysis thus shows that the EQUIPT Tobacco ROI Tool (EQUIPTMOD) is able to produce a detailed information table of outcomes that can support decision making in Hungary. Because of the scarce resources of the health care systems, optimal resource allocation is essential in order to reach the highest possible societal gains. This is especially important in the context of Central and Eastern European countries where the budget for healthcare including smoking cessation interventions is more limited than in other developed countries.

As this analysis is based on the EQUIPTMOD (15), the limitations of the model also apply to our findings and conclusions. The model evaluates only healthcare and quasi-societal perspectives and is not capable for considering the full societal perspective, as might have been relevant to Hungarian context. An important limitation when using the EQUIPTMOD is the restriction posed by probabilistic sensitivity analyses (PSA) functionality. The economic model was developed primarily to underpin a return on investment (ROI) tool for decision-making purposes. This objective inevitably required the tool developers not only to provide a simple generalised user interface (GUI) and granularity of outputs (a number of ROI metrics), but also subjected them significantly to consider Microsoft Excel's own limitations to handle such a large model. The PSA functionality available currently to the users is therefore restricted to sensitivity estimates for current practice versus the baseline. In evaluating uncertainty around the cost-effectiveness of possible future scenarios, we therefore considered an indirect comparison method by subjecting both current practice and prospective scenarios to the baseline. Future analyses will benefit from an update on this particular aspect of the PSA functionality of the EQUIPTMOD.

There are some wider implications of this analysis too. As raised by the stakeholders during this study, different subgroups of smokers may require to be approached by diverse applications of the interventions. This alone can have an effect on the costs directly and may require detailed analysis of the target population. Future analyses could look into these possibilities.

CONCLUSION

The analysis based on the EQUIPTMOD has provided public health authorities in Hungary with policy options for tobacco control. It would be cost-effective to introduce a social marketing campaign and double the reach of existing group-based behavioural support therapies and pro-active telephone support. Over the lifetime, these policies would be cost-saving.

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Table 1: The relative effect, cost, and reach values of the smoking cessation interventions under the current practice in Hungary

Intervention name	Relative effect (source)	Reach – percentage of smokers reached (source)	Unit cost in € (source)
Social marketing	1.03 (18)	Intervention not available in Hungary	Intervention not available in Hungary
Brief physician advice	1.40 (29)	7% (expert opinion)	4.01 (30)
Cut down to quit	2.10 (31)	Intervention not available in Hungary	Intervention not available in Hungary
Rx Mono NRT	1.60 (32)	Intervention not available in Hungary	Intervention not available in Hungary
Rx Combo NRT	1.34 (32)	Intervention not available in Hungary	Intervention not available in Hungary
Varenicline (standard duration)	2.30 (33)	0.21% (expert opinion)	439.17 (34)
Varenicline (extended duration)	1.20 (35)	Intervention not available in Hungary	Intervention not available in Hungary
Bupropion	1.60 (36)	Intervention not available in Hungary	Intervention not available in Hungary
Nortriptyline	2.00 (36)	Intervention not available in Hungary	Intervention not available in Hungary
Cytisine	3.30 (37)	Intervention not available in Hungary	Intervention not available in Hungary
OTC Mono NRT	1.60 (32)	5% (expert opinion)	140.03 (Hungarian retail prices)
OTC Combo NRT	1.34 (32)	Intervention not available in Hungary	Intervention not available in Hungary
Specialist behavioural support: one-to-one	1.40 (38)	0.02% (expert opinion)	32.36 (30)
Specialist behavioural support: group-based	2.00 (38)	0.20% (expert opinion)	11.01 (30)
Telephone support: pro-active	1.40 (39)	0.19% (expert opinion)	51.41 (expert opinion)
SMS text messaging	1.71 (40)	Intervention not available in Hungary	Intervention not available in Hungary
Printed self-help materials	1.19 (41)	0.38% (expert opinion)	0.65 (expert opinion)

Table 2: Input values of the Prospective scenarios 1 and 2

Input values	Prospective scenario 1		Prospective scenario 2	
	Reach of Social marketing	Unit cost of Social marketing (€)	Reach of Specialist behavioral support: group-based	Reach of Telephone support: pro-active
Under current practice	Not available in Hungary	Not available in Hungary	0.20%	0.19%
Under prospective scenario	100%	0.48	0.41%	0.38%

Table 3: ROI of Prospective scenario 1 compared to the current practice (lifetime horizon)

ROI estimate	Prospective scenario 1 vs. current practice		
Avoided Burden of Disease: per 1,000 smokers (QALYs gained per 1,000 smokers)	0.4280		
Avoided Burden of Disease: across all smokers (QALYs gained across all smokers)	1 119.1098		
Benefit-Cost Analysis: healthcare savings (Return on every currency unit invested)	1.9084		
Benefit-Cost Analysis: healthcare savings and value of health gains (Return on every currency unit invested)	20.8036		
ICER Incremental Cost per Life Year gained (Currency unit per Life Year gained)	Dominant*		
ICER Incremental Cost per QALY gained (Currency unit per QALY gained)	Dominant*		
Average cost savings (Currency unit per smoker)	0.6495		
Savings and value of health gains (Currency unit per smoker)	14.1598		
Other model outputs	**Current practice (A)**	**Prospective scenario 1 (B)**	**Difference (B-A)**
Average cost of interventions per smoker	8.3338	9.0488	0.7150
Average healthcare costs per smoker	9 914.3270	9 912.9625	-1.3645
Average total costs per smoker	9 922.6608	9 922.0113	-0.6495
Average QALYs per smoker	12.6433	12.6438	0.0004
Average life years per smoker	15.8613	15.8616	0.0003
Number of quitters per 1,000 smokers	10.3280	10.6295	0.3014
Value of lost productivity (Currency unit per smoker)	730.0470	729.8207	-0.2263
Passive smoking costs in children (Currency unit per smoker)	13.3029	13.2988	-0.0041
Passive smoking costs in adults (Currency unit per smoker)	449.5075	449.3682	-0.1393
Passive smoking costs in adults and children (Currency unit per smoker)	462.8104	462.6670	-0.1435

* Dominant, i.e. cost-saving: the scenario is less expensive to run but generates more life years or QALYs.

Table 4: ROI of Prospective scenario 2 compared to the current practice (lifetime horizon)

ROI estimate	Prospective scenario 1 vs. current practice		
Avoided Burden of Disease: per 1,000 smokers (QALYs gained per 1,000 smokers)	0.1175		
Avoided Burden of Disease: across all smokers (QALYs gained across all smokers)	307.1610		
Benefit-Cost Analysis: healthcare savings (Return on every currency unit invested)	3.1045		
Benefit-Cost Analysis: healthcare savings and value of health gains (Return on every currency unit invested)	33.8423		
ICER Incremental Cost per Life Year gained (Currency unit per Life Year gained)	Dominant*		
ICER Incremental Cost per QALY gained (Currency unit per QALY gained)	Dominant*		
Average cost savings (Currency unit per smoker)	0.2539		
Savings and value of health gains (Currency unit per smoker)	3.9620		
Other model outputs	**Current practice (A)**	**Prospective scenario 1 (B)**	**Difference (B-A)**
Average cost of interventions per smoker	8.3338	8.4544	0.1206
Average healthcare costs per smoker	9 914.3270	9 913.9525	-0.3745
Average total costs per smoker	9 922.6608	9 922.4069	-0.2539
Average QALYs per smoker	12.6433	12.6434	0.0001
Average life years per smoker	15.8613	15.8614	0.0001
Number of quitters per 1,000 smokers	10.3280	10.4108	0.0827
Value of lost productivity (Currency unit per smoker)	730.0470	729.9849	-0.0621
Passive smoking costs in children (Currency unit per smoker)	13.3029	13.3018	-0.0011
Passive smoking costs in adults (Currency unit per smoker)	449.5075	449.4693	-0.0382
Passive smoking costs in adults and children (Currency unit per smoker)	462.8104	462.7710	-0.0394

*Dominant, i.e. cost-saving: the scenario is less expensive to run but generates more life years or QALYs.

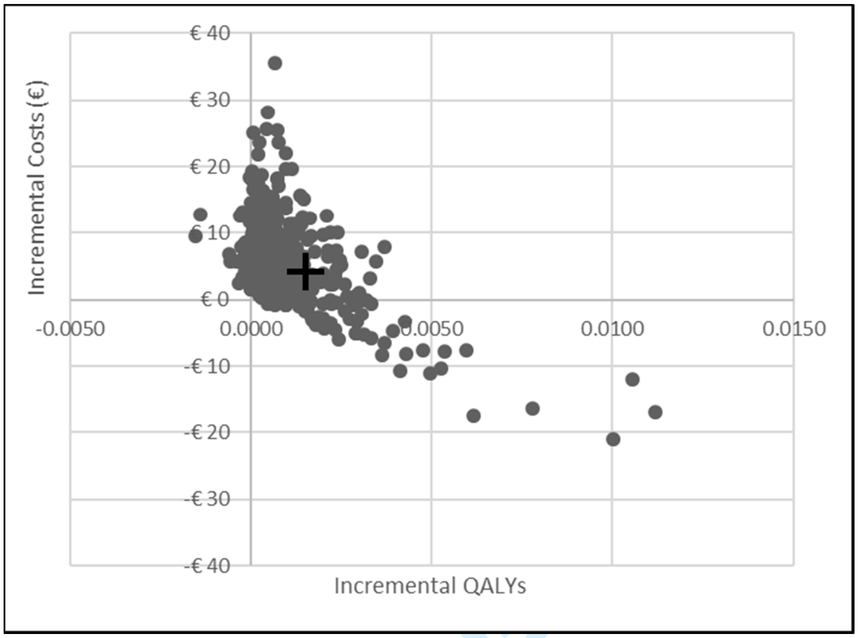
Table 5: ROI of Prospective scenario 3 compared to the current practice (lifetime horizon)

ROI estimate	Prospective scenario 1 vs. current practice		
Avoided Burden of Disease: per 1,000 smokers (QALYs gained per 1,000 smokers)	0.5421		
Avoided Burden of Disease: across all smokers (QALYs gained across all smokers)	1417.3057		
Benefit-Cost Analysis: healthcare savings (Return on every currency unit invested)	2.0767		
Benefit-Cost Analysis: healthcare savings and value of health gains (Return on every currency unit invested)	22.6387		
ICER Incremental Cost per Life Year gained (Currency unit per Life Year gained)	Dominant*		
ICER Incremental Cost per QALY gained (Currency unit per QALY gained)	Dominant*		
Average cost savings (Currency unit per smoker)	0.8960		
Savings and value of health gains (Currency unit per smoker)	18.0062		
Other model outputs	**Current practice (A)**	**Prospective scenario 1 (B)**	**Difference (B-A)**
Average cost of interventions per smoker	8.3338	9.1659	0.8321
Average healthcare costs per smoker	9 914.3270	9912.5989	-1.7281
Average total costs per smoker	9 922.6608	9921.7648	-0.896
Average QALYs per smoker	12.6433	12.6439	0.0005
Average life years per smoker	15.8613	15.8617	0.0004
Number of quitters per 1,000 smokers	10.3280	10.7098	0.3817
Value of lost productivity (Currency unit per smoker)	730.0470	729.76037	-0.2866
Passive smoking costs in children (Currency unit per smoker)	13.3029	13.2978	-0.0052
Passive smoking costs in adults (Currency unit per smoker)	449.5075	449.3311	-0.1765
Passive smoking costs in adults and children (Currency unit per smoker)	462.8104	462.6287	-0.1817

*Dominant, i.e. cost-saving: the scenario is less expensive to run but generates more life years or QALYs.

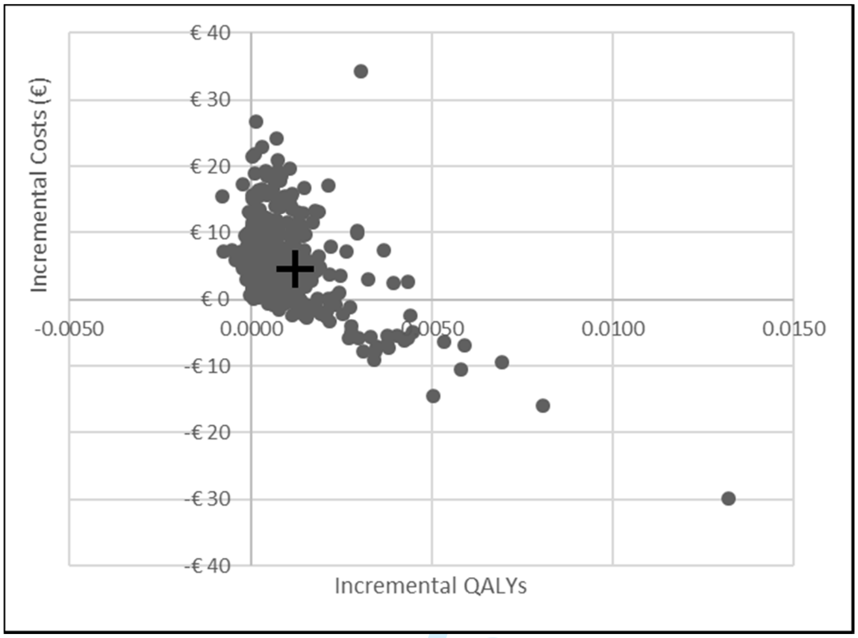
FIGURES

Figure 1: Results of the probabilistic sensitivity analysis, Prospective scenario 1 vs. baseline, 1000 iterations, lifetime horizon



Note: The base-case value is marked with a cross

Figure 2: Results of the probabilistic sensitivity analysis, Prospective scenario 2 vs. baseline, 1000 iterations, lifetime horizon



Note: The base-case value is marked with a cross

Figure 3: Cost-effectiveness acceptability curves for Prospective scenarios 1 and 2 compared to the baseline