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

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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 behavioural support therapies and proactive telephone support; and (c) a combination of the two scenarios. All three scenarios were compared with current practice. The scenarios were chosen as feasible options available for Hungary based on the outcome of interviews with local stakeholders. Life-time costs and quality-adjusted life years (QALYs) were calculated from a health-care 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 0.3014 additional quitters per 1 000 smokers, translating to health-care cost-savings of €0.6495 per smoker compared with current practice. When the value of QALY gains was considered, cost-savings increased to €14.1598 per smoker. Doubling the reach of existing group-based behavioural support therapies and proactive telephone support resulted in health-care savings of €0.2539 per smoker (€3.9620 with the value of QALY gains), compared with current practice. The respective figures for the combined scenario were €0.8960 and €18.0062. 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 proactive telephone support. Such policies would more than pay for themselves in the long term.

Keywords Cost-effectiveness, economic model, Hungary, modeling, return-on-investment tool, smoking cessation.

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INTRODUCTION

Tobacco use is considered to be the most preventable cause of deaths and diseases that can be dealt with using 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, in 2012 Hungary was leading in both incidence and mortality from lung cancer [4]. Based on data provided by the Hungarian Central Statistical Office, the total number of deaths from lung cancer was close to 9000 in 2012 [5] in the country, while in 2010 death from all causes associated with smoking was 20 470 [6]. These high numbers are correlated strongly 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 [7–9]. There are several smoking cessation interventions available globally; however, Central and eastern European (CEE) countries such as Hungary have strict budgetary constraints in various areas of health-care [10], including smoking cessation programmes. In order to utilize 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 (ROI) results of the available programmes [11].

Hungarian stakeholders (decision-makers, service purchasers, academics, researchers and health advocates) have several interventions with the potential to address the issue of tobacco consumption in this country [12]. These include an indoor smoking ban in public places, taxation of tobacco products, brief physician advice, single-form nicotine replacement therapy (NRT), standard-duration varenicline therapy, one-to-one and group-based specialist behavioural support therapies and the use of printed self-help materials. These interventions have been shown elsewhere to be effective and cost-effective [13]. There are other interventions currently in place in Hungary, such as combined health warnings with pictures on packaging of tobacco products. In the Voko *et al*. study, Hungarian stakeholders expressed the need 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 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 ROU 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 behavioural support therapies and proactive telephone support; and the third included a combination of both scenarios. This study evaluated the prospective scenarios compared with current practice.

METHODS

The EQUIPTMOD

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 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 1 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 quality-adjusted life years (QALYs). Costs and outcomes are calculated per cycle then summed and discounted by the predefined discount rate (3.7%) at various time horizons, i.e. 2, 5 and 10 years and life-time (maximum 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, as follows:

(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 cut immediately. 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 being spent actively 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.

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; proactive telephone support; and the use of printed self-help materials. The current practice is the primary comparator in this analysis.

For the 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 in addition to current practice (Table 1). 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 behavioural support therapies and proactive telephone support were doubled from the currently observed rates of 0.20 and 0.19% of all smokers, respectively (Table 1), while leaving the costs and reach of all other interventions unchanged. The feasibility of doubling the reach of proactive telephone support depends upon the health-care system's ability to increase resources (including human resources) to deliver this. Stakeholders agreed that adequate numbers of the relevant work-force is available in Hungary, therefore only additional monetary resources will be required—the level of which was considered to fall within a feasible range. Also, the practicalities of 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 the 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).

ROI estimates

The model provides a total of 18 estimates. The majority of the ROI estimates are expressed as an average per smoker. Estimates such as the additional number of quitters and avoided burden of disease (i.e. the number of QALYs gained) are expressed as per 1000 smokers or throughout 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 current practice.

Other ROI estimates include the value of productivity gains due to reduction in absenteeism and the health-care

Table 1 Input values of prospective scenarios 1 and 2.

	Prospective scenario 1		*Prospective scenario 2*	
Input values	*Reach of social marketing*	*Unit cost of social marketing (€)*	*Reach of specialist behavioural support: group-based*	*Reach of telephone support: proactive*
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%

cost-savings due to reduction in passive smoking-attributable diseases [lower respiratory infections, otitis media and asthma in children; and asthma, lung cancer and coronary heart disease (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 health-care savings only and the other with health-care savings plus the monetary value of QALY gains. The monetary value of health-care 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 the 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

Model input data were required to conduct this analysis. As the analysis took the life-time 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 detail in Table 2. 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 from 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 below the lower cost-effectiveness threshold that equals twice 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 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 €31563.08/QALY based on the data provided by the Hungarian Central Statistical Office [28]. This willingness-to-pay threshold was used to

Table 2 The relative effect, cost and reach values of the smoking cessation interventions under 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: proactive	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)

NRT = nicotine replacement therapy; OTC = over-the-counter; SMS = short message service.

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 log-normal 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

In Hungary, an average of €9914 per smoker is being spent currently on the treatment of smoking-related diseases. The current provision of smoking cessation interventions costs €8.33 per smoker to the health-care system. However, this provision also generates 10.33 quitters per 1000 smokers, and results in 12.64 QALYs per smoker over the life-time horizon. Compared to baseline, every €1 spent on the current provision would generate €4.55 over the life-time horizon if the monetary value of QALY gains were considered in the return on investment calculation.

ROI of prospective scenarios

Detailed results for all 18 ROI estimates are presented in Tables 3–5.

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 current practice on a life-time horizon. Every €1 invested in prospective scenario 1 would generate €20.80 over the life-time horizon if the monetary value of QALY gains is considered (Table 3).

Similarly, prospective scenario 2 (doubling the reach of selected interventions) is also dominant compared to current practice. Every €1 invested in prospective scenario 2 would generate €33.84 over the life-time 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 current practice.

Table 3 ROI of prospective scenario 1 compared to current practice (life-time horizon).

ROI estimate	*Prospective scenario 1 versus current practice*		
Avoided burden of disease: per 1000 smokers (QALYs gained per 1000 smokers)	0.4280		
Avoided burden of disease: across all smokers (QALYs gained across all smokers)	1119.1098		
Benefit–cost analysis: health-care savings (return on every currency unit invested)	1.9084		
Benefit–cost analysis: health-care 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[a]		
ICER incremental cost per QALY gained (currency unit per QALY gained)	Dominant[a]		
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 health-care costs per smoker	9914.3270	9912.9625	−1.3645
Average total costs per smoker	9922.6608	9922.0113	−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 1000 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

[a]Dominant, i.e. cost-saving: the scenario is less expensive to run but generates more life-years or QALYs. ICER = incremental cost-effectiveness ratios; ROI = return on investment; QALY = quality-adjusted life-years.

Table 4 ROI of prospective scenario 2 compared to the current practice (life-time horizon).

ROI estimate	*Prospective scenario 2 versus current practice*		
Avoided burden of disease: per 1000 smokers (QALYs gained per 1000 smokers)	0.1175		
Avoided burden of disease: across all smokers (QALYs gained across all smokers)	307.1610		
Benefit–cost analysis: health-care savings (return on every currency unit invested)	3.1045		
Benefit–cost analysis: health-care 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[a]		
ICER incremental cost per QALY gained (currency unit per QALY gained)	Dominant[a]		
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 2 (B)*	*Difference (B–A)*
Average cost of interventions per smoker	8.3338	8.4544	0.1206
Average health-care costs per smoker	9914.3270	9913.9525	−0.3745
Average total costs per smoker	9922.6608	9922.4069	−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 1000 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

[a]Dominant, i.e. cost-saving: the scenario is less expensive to run but generates more life-years or QALYs. ICER = incremental cost-effectiveness ratios; ROI = return on investment; QALY = quality-adjusted life-years.

Table 5 ROI of prospective scenario 3 compared to current practice (life-time horizon).

ROI estimate	*Prospective scenario 3 versus current practice*		
Avoided burden of disease: per 1000 smokers (QALYs gained per 1000 smokers)	0.5421		
Avoided burden of disease: across all smokers (QALYs gained across all smokers)	1417.3057		
Benefit–cost analysis: health-care savings (return on every currency unit invested)	2.0767		
Benefit–cost analysis: health-care 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[a]		
ICER incremental cost per QALY gained (currency unit per QALY gained)	Dominant[a]		
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 3 (B)*	*Difference (B–A)*
Average cost of interventions per smoker	8.3338	9.1659	0.8321
Average health-care costs per smoker	9914.3270	9912.5989	−1.7281
Average total costs per smoker	9922.6608	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 1000 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

[a]Dominant, i.e. cost-saving: the scenario is less expensive to run but generates more life-years or QALYs. ICER = incremental cost-effectiveness ratios; ROI = return on investment; QALY = quality-adjusted life-years.

This scenario is therefore dominant, but the number of quitters and the amount of cost savings are higher than those in the case of scenarios 2 and 3 (Table 5).

All prospective scenarios result in fewer average costs per smoker, while more QALYs and life-years are gained among all smokers. All prospective scenarios reduce smoking-related productivity loss and also the costs associated with passive smoking of children and adults (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 baseline. The social marketing campaign remained a dominant alternative compared to baseline in 7.8% of the model runs. Prospective scenario 1 produced more QALYs with more investment (costs), but still had an ICER below the Hungarian willingness-to-pay threshold of €31563.08/QALY in 53.8% of all cases, presenting it as a cost-effective alternative scenario compared to baseline in a total of 61.6% of all model runs. The scatterplot diagram of this sensitivity analysis is presented in Fig. 1.

Doubling the reach of group-based specialist behavioural support therapy and proactive telephone support programmes (prospective scenario 2) resulted in more QALYs per smoker in 89.8% of all cases, while costs savings were observed in 5.8% of all cases, compared with baseline. Therefore, this scenario remained a dominant alternative compared to 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 baseline in a total of 66.0% of all model runs. The scatterplot diagram of this sensitivity analysis is presented in Fig. 2.

The cost-effectiveness acceptability curves (CEAC) are presented for both prospective scenarios in Fig. 3. There are only minor differences between the two curves, as the CEAC of prospective scenario 2 is slightly above the one calculated for prospective scenario 1. At a willingness-to-pay (WTP) threshold of €30 000/QALY, the probability of being cost-effective is 61% for scenario 1 and 65.6% for scenario 2. Prospective scenario 1 has a 50% probability of being cost-effective at a threshold value of €18 900/QALY, while prospective scenario 2 has a 50% probability of being cost-effective at a threshold value of €16 300/QALY. Both these values are lower than the Hungarian willingness-to-pay threshold of €31563.08/QALY.

DISCUSSION

This study shows that introducing a country-wide social marketing campaign and expanding the reach of group-based specialist behavioural support therapy and proactive telephone support programmes 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

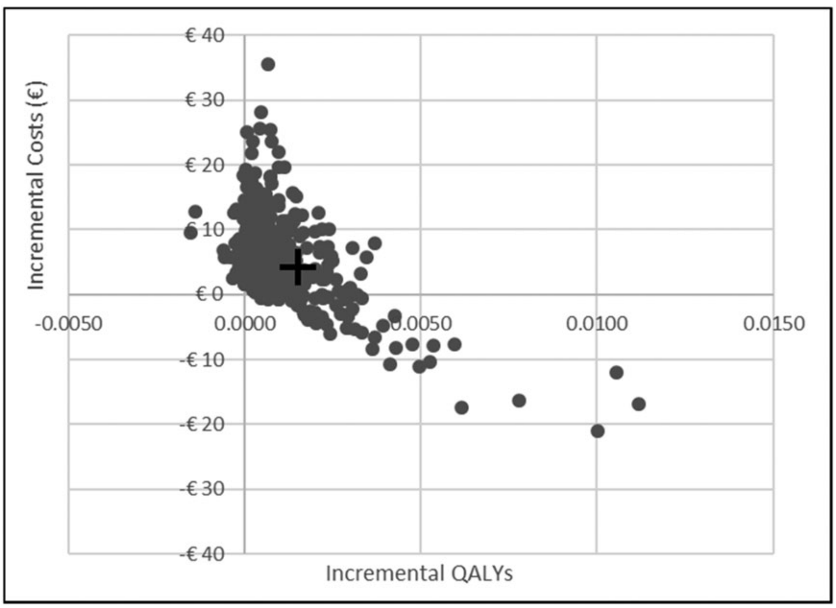

Figure 1 Results of the probabilistic sensitivity analysis, prospective scenario 1 versus baseline, 1000 iterations, life-time horizon. The base-case value is marked with a cross

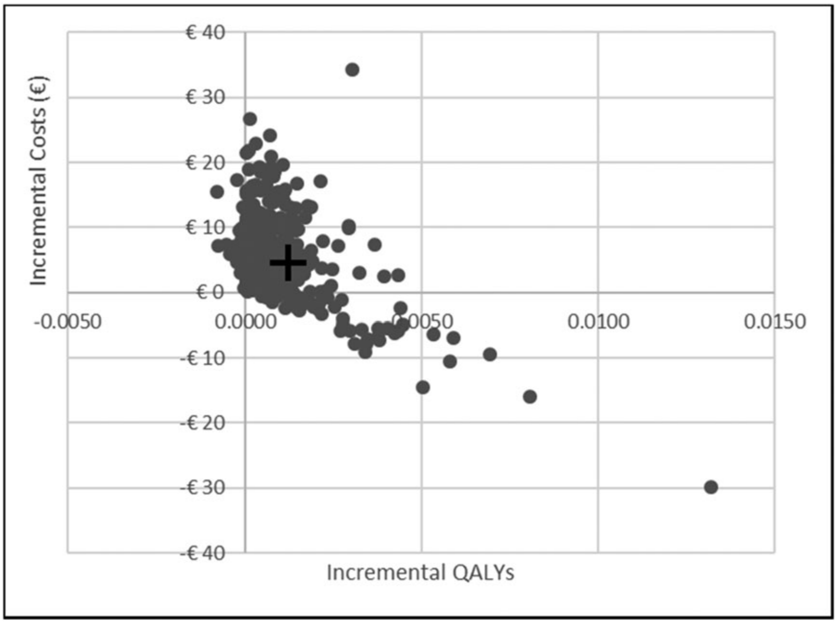

Figure 2 Results of the probabilistic sensitivity analysis, prospective scenario 2 versus baseline, 1000 iterations, life-time horizon. The base-case value is marked with a cross

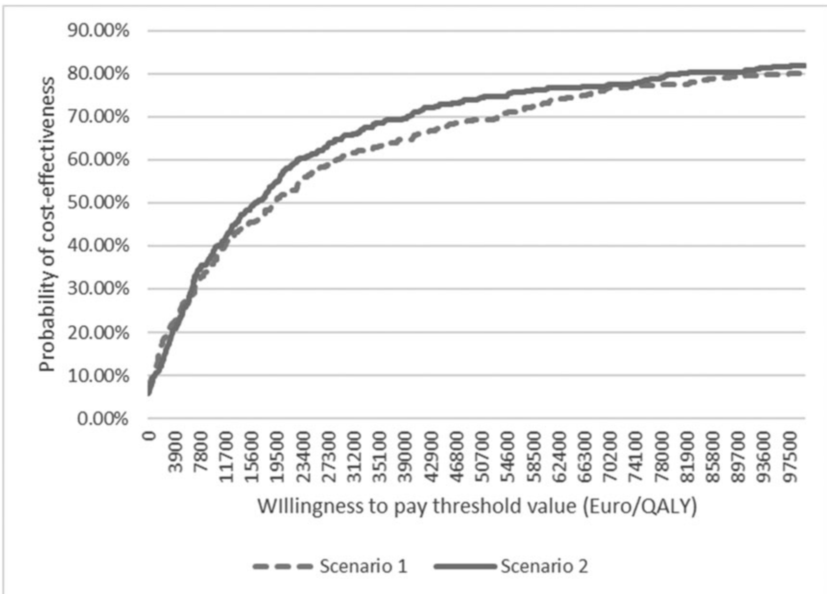

Figure 3 Cost-effectiveness acceptability curves for prospective scenarios 1 and 2 compared to the baseline

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 a higher number of current smokers making quit attempts compared to 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 the benefits could easily be lost by poor implementation/financial management. Conversely, although the group-based specialist behavioural support therapy and proactive telephone support programmes have higher relative effects (2 and 1.4, respectively), given their low reach (0.41 and 0.38%) among current smokers, we would expect only a few more current smokers succeeding in their quit attempts. Therefore, the results of the proposed changes will have marginal effects on the entire smoking population, but are considered to have a reasonable impact upon the number of quit successes in the groups of smokers who 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.

While our analysis provides the health and economic value of alternative strategies to complement the current provision of smoking cessation in Hungary, 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 approximately 2 in 3. However, it is important to put this uncertainty into perspective, and consider the significant health gains that these strategies would generate over time compared to the current service provision.

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 health-care and quasisocietal perspectives and is not capable of considering the full societal perspective, as might have been relevant in the Hungarian context. An important limitation when using the EQUIPTMOD is the restriction posed by PSA functionality. The economic model was developed primarily to underpin an ROI tool for decision-making purposes. This objective inevitably required the tool developers to not only provide a simple generalized user interface (GUI) and granularity of outputs (a number of ROI metrics) but, significantly, also subjected them to consider Microsoft Excel's own limitations to handle such a large model. The PSA functionality available currently to users is therefore restricted to sensitivity estimates for current practice versus baseline. In evaluating uncertainty concerning 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. As raised by the stakeholders during this study, different subgroups of smokers may be required to be approached by diverse applications of the interventions. This alone can have a direct effect on the costs and may require detailed analysis of the target population. Future analyses could investigate these possibilities.

CONCLUSION

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 proactive telephone support. During the life-time, these policies would be cost-saving.

Ethics approval

Ethical approval was not applicable to this study, as this was based on secondary data. However, the main study EQUIPT has obtained ethics approval from the Brunel University London Research Ethics Committee and relevant authorities from participating countries.

Declaration of interests

None.

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