World Health Organization

It's time to invest in cessation

THE GLOBAL INVESTMENT CASE FOR TOBACCO CESSATION

Methodology and results summary

It's time to invest in cessation: the global investment case for tobacco cessation. Methodology and results summary

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METHODOLOGY

The objective of this document is to describe the methodology used to build a model that estimates the return on investment (ROI) of tobacco cessation programmes. The approach builds largely from previous methodologies and tools developed over the last 20 years to support the implementation of WHO 'best buy' NCD interventions (Johns et al., 2003; WHO, 2011; Bertram et al., 2017; WHO 2018).

The model includes 124 middle-income countries and low-income countries with available gross domestic product (GDP) and United Nations (UN) population data. ROI ratios were individually estimated for each country and then for purposes of reporting totals, the costs and benefits were aggregated separately and a single ROI ratio was generated for each income group. In 2021, the estimated population in these countries totalled 6.5 billion and tobacco users aged 15+ totalled 1.05 billion – overall prevalence of 22% (15+).

The methodology does not propose or evaluate funding options or arrangements for the cessation programmes modelled in this exercise – that is, it simply takes a cost perspective to be able to understand the resources needed to plan, develop and implement cessation programmes. The assumptions used, particularly those related to target coverage, take an evidence-based (when possible), reasonable perspective to the extent they can be met regardless of any specific funding approach.

The following sections describe the data sources used, assumptions and decisions made when estimating the additional investment costs, including those directly related to the cessation interventions or programmes, and the approach taken to estimate the outcomes of the interventions. The document also describes the analyses conducted and briefly presents the main results of the model.

A. DATA SOURCES, SUMMARY OF INTERVENTIONS, AND SCALE-UP PATTERN

The model uses predominately publicly available data from a variety of sources, including the World Health Organization Global Health Observatory, the United Nations Population Division, the World Bank, and the International Labour Organization. The WHO-CHOICE price database was also an important data source used in this modelling exercise. WHO-CHOICE produces global prices for

major cost categories (e.g. personnel, utilities), and alongside a guiding methodology, it aims to facilitate the estimation of disease control programme support costs at the individual country level (Bertram et al., 2017).

Other sources of data and information used in this exercise include major reports (e.g. 2019 and 2021 WHO Report on the Global Tobacco Epidemic), research papers, unpublished data collected by WHO (e.g. cost of cessation medications, national quitline users), and various public websites (e.g. US Bureau of Labor Statistics, numbeo.com).

Table 1. Modeled Cessation Interventions with Coverage Targets and Effect Sizes Used

	Intervention	**Definition / Description**	**Assumed Coverage Target**	**Impact / Effect Size** % of intervention users who quit tobacco
Population-level Interventions	Brief advice	Advice to stop using tobacco, usually taking only a few minutes, is given to all tobacco users during the course of a routine consultation and/or interaction with a physician or health care worker.	An additional 30% of all tobacco users aged 15+ beyond current coverage	2%
	National toll-free quitline	A national toll-free quit line is a telephone counselling service that can provide both proactive and reactive counselling. A reactive quit line provides an immediate response to a call initiated by the tobacco user, but only responds to incoming calls. A proactive quit line involves setting up a schedule of follow-up calls to tobacco users to provide ongoing support.	5% of all tobacco users aged 15+	5%
	mCessation	Tobacco cessation interventions are delivered via mobile phone text messaging. Mobile technologies provide the opportunity to expand access to a wider population, and text messaging can provide personalized tobacco cessation support in an efficient and cost-effective manner.	3.5% of all tobacco users aged 15+	4%

Pharmacological Interventions	Nicotine replacement therapy (NRTs)	NRTs are available in several forms including gum, lozenges, patches, inhalers and nasal spray. These cessation tools reduce craving and withdrawal symptoms by providing a low, controlled dose of nicotine without the toxins found in cigarettes. The doses of NRT are gradually reduced over time to help the tobacco user ween off of nicotine by getting used to less and less stimulation.	An additional 5% on top of estimated current NRT use among tobacco users aged 15+ (varies per country)	6%
	Bupropion	Non-nicotine pharmacotherapy: These pharmacotherapies reduce cravings and withdrawal symptoms and decrease the pleasurable effects of cigarettes and other tobacco products.	An additional 1.5% on top of estimated current NRT use among tobacco users aged 15+ (varies per country)	7%
	Varenicline	Non-nicotine pharmacotherapy: These pharmacotherapies reduce cravings and withdrawal symptoms and decrease the pleasurable effects of cigarettes and other tobacco products.	An additional 1.5% on top of estimated current NRT use among tobacco users aged 15+ (varies per country)	15%

For the purposes of this analysis, ambitious implementation and coverage scale up patterns were modelled, in order to demonstrate the impact that an increased commitment to tobacco cessation could yield. For all interventions, expert opinion was sought from WHO technical groups related to the quickest possible time in which interventions were believed to be implementable. The scale-up pattern was based on current implementation status of cessation interventions, taken from the 2021 WHO Report on the Global Tobacco Epidemic. For countries considered to have little to no implementation of a particular intervention, one year was allotted for planning, next for development, and only on Year 3 would there be full implementation according to the target coverage. For countries already implementing at a level close to the target, then full implementation would be from year 1.

B. INVESTMENT COSTS

The investment costs build from the NCD costing tool and approach (WHO, 2011), and are grouped into two major categories: supporting and programme management costs and intervention costs. Given the comprehensive scope of cessation interventions, for most countries, intervention costs account for more than 95% of total investment costs – and for many up to 99%.

B.1. Supporting and programme management costs

This category incorporates all costs directly associated with supporting and managing the planning, development and implementation of the cessation programmes. Major sub-categories within this group include human resources, training & meetings, media, and rent, supply and equipment. For example, training sessions need to be coordinated and provided to quitline counsellors and for those directly involved with providing brief advice in the community and/or across the health care system. Similarly, public health specialists and officers, policy advisors, and epidemiologists and economists are needed to support policy development, research, guidelines development, and/or the development of programme funding models.

The NCD costing tool accounts for population size when it comes to these costs of the investment exercise. That is, supporting and programme management activities are costlier (in absolute terms) in countries with larger populations – given the need for more quitline counsellors, training sessions, and more oversight, monitoring and reporting activities. For the purpose of this modeling exercise, some changes were introduced. The first one relates to the use of a band that allows human resources (needed for every aspect of the programme development process) to vary by population size within certain limits. The lower limit captures the concept of a baseline or minimum number of full-time equivalents (FTEs.) needed to implement and manage the programmes. For example, a minimum amount of public health specialists' time will be needed regardless of the size of the country. Similarly, an upper threshold was also incorporated to limit the number of FTEs so that they do not increase unreasonably. A similar rational was likewise applied for quantities used to estimate the cost of training and meetings, so that the number of meetings and attendees was not unreasonably low or high.

These cost categories rely importantly on the WHO CHOICE price database. Updates were introduced, however, to reflect more up-to-date price levels – i.e. from 2019 and 2020 when available. For example, the latest information on world salaries available from the International Labour Organization is from 2019, and World Bank purchasing power parity (PPP)-related rates are from 2019 – although estimated using 2021 price levels. Other estimations used in this section incorporate the use of the UN Daily Subsistence Allowance (DSA) – which is available for every UN member state. For this purpose, the UN 2021 DSA was used to reflect current price levels. For example, the office space rental price (in US$ per square foot per year) for a premium location was estimated to be 19% of the UN DSA.

B.2. Intervention costs

This category includes costs directly related to the cessation interventions or programmes – these costs are largely variable. For example, for a national toll-free quitline the most relevant direct costs

include the unit cost per call and the salary of the counsellors – the larger the number of tobacco users to be reached, the higher the cost.

These direct intervention cost estimates capture additional (or expanding) programme costs required to reach a target coverage. For example, if a country is currently counselling 1% of current tobacco users through a national toll-free quit line and the target coverage is set at 5%, then the cost estimates in this modelling exercise would capture the costs needed to reach the additional 4% of tobacco users. Similarly, if the target coverage is set at 5% and a country is already counselling 5% of tobacco users, then the cost estimates would theoretically be nil – however, this was not the case in any of the countries included in this analysis. The following section details the costs directly related to each of the six cessation programmes modelled in this exercise, and the decisions made about target coverage.

National toll-free quitline:

The target coverage for this intervention was set at 5% for all countries. That is, either reactively and/or proactively, countries should reach 5% of yearly tobacco users through this cessation service. This assumption is based on the case of New Zealand, where the national quitline has been able to reach 5% of tobacco users (WHO, 2011). Evidence from a limited number of countries also shows that currently quitline users account for less than 0.5% of tobacco users. For the purpose of this modelling exercise, current coverage was set at 0% in countries where there is no quitline available, as reported to WHO in the 2021 Report on the Global Tobacco Epidemic, and at 0.5% in countries reporting a quitline service.

The main cost drivers for this service include the direct cost of the call (i.e. the telecom provider cost), and salaries of quitline counsellors. Call cost assumes 40 minutes per tobacco user reached. That is two calls per smoker at 30-min initial and 10-min follow-up calls. Unit price was derived from ITU (Bertram et al., 2017) in combination with US information on costs associated with toll-free 800 call services. Quitline counsellors were assumed to take 5,280 calls per year in an 8-hour/day shift, five days per week. Salaries were modelled using data available from the ILO up to 2019.

Brief advice:

Brief advice takes advantage of encounters within the healthcare system. Following the current tobacco cessation support reported across various providers within the healthcare system (WHO, 2021), countries were arbitrarily classified into 5 groups to represent current coverage – which was estimated to range from 0% to 40%. For example, a coverage of 20% means that through this intervention, 20% of tobacco users are currently receiving tobacco cessation counselling by a healthcare provider per year. This assumption depends on various factors, however, including the

current capacity of the healthcare system in a country and the extent of patient access to healthcare services within. The target coverage was set at an additional 30% increase beyond current coverage. The costs used in this intervention involve only those directly related to providing the counselling – that is a fee to the healthcare provider. It does not incorporate expansions in capacity the healthcare system may need to actually meet the needs for additional counselling (e.g. increased number of GPs per capita).

The costing approach for this intervention follows the Canadian model (MOH, 2021). It uses an incentive approach based on a flat fee (CAD$ 15.6) paid to a general practitioner if counselling is provided to the patient within a regular consultation visit. It is covered every 12 months per tobacco user (and/or patient) and has the option of 2 follow-ups after the initial consultation within the 12-month period. To standardize this approach across countries, the fee was combined with data reported by Moses et al. (2019), who estimated the average cost of an outpatient visit in 188 countries. For Canada, the counselling fee was estimated to represent 13% of the average cost of an outpatient visit. This percentage was then applied to all countries to estimate the unit cost of a brief advice. For the purpose of this analysis, only one counselling or advice per year per tobacco user was modelled.

mCessation:

This intervention was modelled following a smoking cessation programme delivered in the United Kingdom by mobile phone text messaging (Guerriero et al., 2013) – participants received five text messages per day for the first five weeks and three per week for the next 26 weeks. Given that participation in this type of intervention requires that smokers actually subscribe to the programme (the equivalent of what smokers would do when calling the quitline), coverage should be expected to be relatively low – In India, for example, mCessation subscribers represent slightly less than 1% of total tobacco users. For this modelling exercise, target coverage was set a bit higher at 3.5% of the yearly base of tobacco users. For virtually every country, current coverage was assumed to be 0%.

The total cost of this programme was estimated at GBP$ 16.12 per smoker – largely driven by the unit cost of GBP$ 6 cents per message (Guerriero et al., 2013). To account for variation in the cost of living across countries, the cost of this programme was modelled in relative terms using the UN DSA. The direct per smoker total cost of the programme was estimated at 7% of the UN DSA. The model also includes the cost of setting up (and maintaining) the messaging coding system – which was a fixed cost estimated at 1.7 times the UN DSA per year. It was negligible when compared to the variable cost of text messaging.

Nicotine replacement therapies (NRTs):

Current NRT coverage is based on information reported in the 2021 WHO Report on Global Tobacco Epidemic and on data reported in research studies (Shahab et al., 2014; Hammond et al., 2008). Countries were arbitrarily classified into 4 groups to represent current coverage – which was estimated to range from 0% (NRT unavailable in the country) to 1.2% (NRT available and cost-covered, where provided). For example, a coverage of 0.5% means that 0.5% of tobacco users are currently using NRTs. The very low proportion of NRT use is based on various arguments and assessments, including (i) the high price tag attached to the course of therapy, (ii) the fact that the base countries in this modelling exercise involve only middle income and low-income countries, and (iii) for most countries, the cost of NRTs is not covered or partially covered. In addition, in high-income countries where the cost of NRTs is partially covered, utilization among smokers averages approximately 17%. When modelling this section, a coverage scenario that involves an additional 5% of yearly tobacco users was used.

For the NRT unit price, data from the 2019 WHO Report on Global Tobacco Epidemic was employed. It involves pricing a full 8-week course of therapy using 532 gums or 56 patches. The pricing information involved 57 countries and looked at the lowest price available. To standardize the therapy unit price across countries, the price of gum therapy only was linked to GDP per capita. The analysis shows that in lower middle-income countries, the cost of a full 8-week course therapy averages 2.80% of GDP per capita. This cost was also proportionally lower in higher income countries. There was no data for low-income countries. For the purpose on this analysis a rate of 2.0% of GDP was used for lower middle-income countries, 2.4% for low-income countries, and 1.4% for upper middle-income countries. These percentages assume lower unit prices due to the use of bulk purchasing mechanisms.

Bupropion/Varenicline:

Given the high price tag attached to a full course of Bupropion and Varenicline, current coverage (or use) was set below that used for NRTs. Countries were arbitrarily classified into 4 groups to represent current coverage – which was assumed to range from 0% (medication unavailable in the country) to 0.8% (medication available and cost-covered, where provided). When modelling this section, a coverage scenario that involves reaching an additional 1.5% of yearly tobacco users was used.

Unit price was derived from a small sample of countries where a 12-week treatment course was estimated by WHO. To standardize the therapy unit price across countries, the price of Bupropion and Varenicline was linked to GDP per capita. The analysis shows that in lower middle-income countries, the cost of a full 12-week course therapy averages 8.5% (Bupropion) and 7.5% (Varenicline) of GDP per capita. This cost was also proportionally lower in higher income countries. There was no data for low-income countries. For the purpose on this analysis a rate of 1.8%

(Bupropion) and 2.8% (Varenicline) was used for upper middle-income countries, and 10% for low-income countries.

C. BENEFITS

Benefits were measured by tobacco quitters and all-cause mortality averted due to quitting (i.e. lives saved). To estimate the total number of tobacco quitters, effect sizes from the 2019 WHO Report on Global Tobacco Epidemic were used. These effects were built from meta analyses and are interpreted as the percentage of tobacco users who quit after the intervention (WHO, 2019). They are assumed to be independent and range from 2% for brief advice to 15% for the pharmacological intervention Varenicline. Quitters were also assumed to remain quitters over time for the purpose of modelling. The effect sizes used for the interventions represent those who remain quitters six months after the intervention, and already take into account the sizeable majority of relapses occurring during the first six months after a quit attempt.

To avoid under- or over-estimations of benefits at the country level, benefits were separately modelled for sex- and age-specific groups. For any given country, the model first estimates the total number of quitters using overall effect sizes, and then it distributes quitters following the actual sex and age distributions of tobacco users. Given the limited data on sex- and age-specific prevalence at the country level, the model re-estimates prevalence (for every country) using the global sex- and age-distributions of tobacco users (WHO, 2019). The model calculates dynamically tobacco users every year – that is, it considers simultaneously UN population growth projections, trends in tobacco use prevalence, and yearly quitters estimated by the model. Country-level prevalence data was taken from the 2021 WHO Report on Global Tobacco Epidemic, and was modeled with a linear regression model using a least squares approach to estimate yearly prevalence for the period 2021-2030.

All-cause mortality averted due to quitting was estimated using age- and sex-specific 10-year risk ratios (RRs) from Woloshin et al. (2008) as presented in Table 2, where the mortality risk of former smokers was compared to that of current smokers – comparing risks between current smokers and never smokers would have resulted in over estimations of lives saved. The rates used in this modelling exercise are also consistent with other comprehensive studies – Prabhat et el. (2008) in India, Thun el at. (1995) looking at 20-year interval in excess mortality. Studies typically do not include mortality risks for population below 35 years of age or above 80. For the purpose of this analysis, mortality risks for populations below 35 were assumed to be 1.0 and for those above 75 were assumed to be similar to the last age category (Table 2). Using all-cause mortality has the advantage of capturing comprehensively the full effect of smoking on mortality, in addition to avoiding the confounding effects of competing risks of mortality from specific conditions (Woloshin et al., 2008).

Table 2. 10-year mortality risk across smoking status

		Male			Female		
Age	**Age group***	**NS**	**FS**	**CS**	**NS**	**FS**	**CS**
20	15-24	1.0	1.0	1.0	1.0	1.0	1.0
30	25-34	1.0	1.0	1.0	1.0	1.0	1.0
35	35-37	**1.0**	**1.53**	**2.80**	**1.0**	**1.07**	**1.00**
40	38-42	**1.0**	**1.42**	**2.58**	**1.0**	**1.37**	**1.42**
45	43-47	**1.0**	**1.40**	**2.60**	**1.0**	**1.48**	**1.80**
50	48-52	**1.0**	**1.47**	**2.61**	**1.0**	**1.41**	**1.86**
55	53-57	**1.0**	**1.51**	**2.51**	**1.0**	**1.45**	**2.00**
60	58-62	**1.0**	**1.44**	**2.23**	**1.0**	**1.49**	**1.99**
65	63-67	**1.0**	**1.40**	**2.07**	**1.0**	**1.46**	**1.84**
70	68-72	**1.0**	**1.24**	**1.76**	**1.0**	**1.46**	**1.62**
75	73-77	**1.0**	**1.16**	**1.49**	**1.0**	**1.35**	**1.38**
80	78-84	1.0	1.2	1.5	1.0	1.4	1.4
85+	85+	1.0	1.2	1.5	1.0	1.4	1.4

Note: Highlighted values from Woloshin et al. (2008). Studies typically do not include mortality risks for population below 35 years of age or above 80. For the purpose of this analysis, mortality risks for populations below 35 were assumed to be 1.0 and for those above 75 were assumed to be similar to the last age category.
NS: Never smokers. FS: Former smokers. CS: Current smokers.
* For modelling purposes

Sex- and age-specific all-cause mortality rates for former smokers and current smokers were estimated using UN country-specific life tables re-calibrated to a 10-year cycle following the methodology described by Woloshin et al. (2008). The methodology proposes that all-cause mortality rate in a population is the weighted average of mortality rates for never smokers (NS), former smokers (FS), and current smokers (CS), where the weights reflect the proportion of the population in each group (Woloshin et al., 2008). As a proxy for former smokers, the model uses a 5-year difference in prevalence, and mortality rates for former and current smokers are expressed as a function of mortality rate for never smoker using RRs (Table 2). The difference between CS and FS mortality rates is the proportion of quitters whose lives are saved during a 10-year cycle because of quitting. Sex- and age-specific life tables for former and current smokers were also built over a period of 70 years to be able to estimate total lives saved at any point in time during the lifetime of quitters.

Lives saved were then translated into economic and social benefits. For this purpose, the model uses a conservative value of 1.45 times the GDP per capita for a life-year saved (i.e. value of a statistical life, VSL = 1.45). Economic and social benefits were estimated until a specified year (e.g. 2030) and/or until quitters reach the age of 65 years (whatever came first). VSL is based on previous work by Stenberg et al. (2014) and the value of 1.45 already incorporates adjustments to account for years lost due to disability as estimated by Struijk et al., (2013). That is, in a 10-yer cycle, quitters whose lives have been saved can expect to live approximately 9 out 10 years in good health, on average.

VSL in this analysis represents the imputed value of the direct contribution a person makes to the economy through the production of goods and services, and the indirect contribution a person makes to the rest of society – e.g. being a member of a community (Colmer, 2020; Stenberg et al., 2014).

The estimation of benefits is specific to sex and age groups. For example, a 25-year old male who stops smoking in 2021 does not produce any additional economic and social benefits over the next 10 years since there is no difference in 10-year mortality rates between current smokers and former smokers. However, in 2031 the 25-yearl old male will be 35, point at which there is a significant difference in 10-year mortality rates between current smokers and former smokers – thus economic and social benefits begin to accrue. In 2041, the 25-year old male will be 45, point at which there is also a significant difference in 10-year mortality rates, but different than that 10 years earlier. This process of follow-up each sex- and age-specific group of tobacco users who quit during the period 2021-2030 required the construction of more than 450 independent schedules of benefits. These schedules were populated with (1.45 x) GDP per capita (at current 2021 price level) projected linearly using 70-year historical data from the World Bank. Using a discount rate of 3%, net present values were then estimated from these schedules and multiplied by yearly lives saved to derive the total economic and social benefits. NPVs were however adjusted to account for the economic and social benefits tobacco users (i.e. the comparator group) would accrue before they die. That is, if tobacco users die in the middle of a 10-year cycle, they would still contribute to society during a period of time. These benefits were removed from the total economic and social benefits initially estimated.

This model uses a conservative approach when estimating economic and social benefits. First, as argued by Stenberg et al (2014), the use of a VSL of 1.5 (or 1.45 in this model) is conservative and at the lower end of values used in the literature (Jamison et al., 2013). Greater values would lead to greater returns. Second, the model assumes no difference in mortality risks due to tobacco use in younger populations – that is the incremental 10-year mortality risk begins at the age of 35. This means the model did not estimate economic and social benefits for those aged 15 to 30 years when the time horizon of the analysis was 2030. When quitters age, however, they move to older age groups where there are significant differences in mortality rates (Table 2) – in these cases, their economic and social benefits were accounted for. Third, the model does not estimate disability-related gains due to quitting for those who did not die during a 10-year cycle. If estimated, the economic and social benefits would have been greater.

D. ANALYSIS

This analysis focuses on the benefit-to-cost ratio or return on investment (Stenberg et al, 2014). The ratio compares the net present value of the investment (or cost) with that of the economic and social benefits. The timeframe for the investment is 2021-2030. Benefits were evaluated at the end of 2030 and when tobacco users who quit during the investment period reach the age of 65 years. This occurs as early as 2025 for quitters 60 years of age at the time of the intervention in 2021 and

as late as 2074 for quitters 20 years of age who would be exposed to the interventions the last year of the investment period (i.e. 2030).

The analysis includes a base scenario, where all six interventions (as a full package) are assumed to be introduced, and where assumptions are to the extent possible evidence-based. In the base scenario, population-level and pharmacological interventions were also separately modelled to estimate their unique contribution to cessation efforts. An additional two simulation scenarios were also modelled. The first one includes all population-level interventions and NRTs only, where NRT prices were reduced to the point a ROI of 1 could be reached by 2030 in countries where this ratio was below 1 – with the limitation that prices could decrease up to 50% (maximum). Similarly, a second scenario includes all six interventions, and prices for all pharmacological interventions were also reduced to the point a ROI of 1 could be reached by 2030 – prices, however, were allowed to decrease up to 90% (maximum). In this scenario, the model also attempted to minimize the absolute reduction in prices.

All scenarios present combined results for all 124 middle- and low-income countries, for 49 upper middle-income countries, and for 75 lower middle-income and low-income countries.

E. RESULTS

Table 3 summarizes the results of this modelling exercise. The base scenario (all 124 countries) shows that over the next 10 years, all six programmes could help quit approximately 150 million tobacco users and save 2.7 million lives, if quitters were followed until 2030. If quitters were followed until they reach 65 years of age, lives saved due to quitting may accumulate 16 million. The combined investment cost of these interventions would be US$ 1.68 per capita per year, or US$ 115 billion over the next 10 years. The model estimates a return of US 0.80 dollar (measured at the end of 2030) for every US 1.0 dollar invested, and of US 7.5 dollar for every US 1.0 dollar invested, if benefits were assessed until quitters reach the age of 65 years.

In upper middle-income countries, the model estimates a return on investment of US$ 1.0 (until 2030), and in lower middle-income and low-income countries the model estimates a return of US$ 0.44 for every dollar invested (until 2030). In the long run (i.e. until quitters reach 65 years of age), ROIs are greater than 1.0 in these two groups of countries. If only population-level interventions were to be introduced, ROIs would be greater than 1.0 in the short term (i.e. until 2030) and in the long term (i.e. until quitters reach 65 years of age). Pharmacological interventions alone are cost beneficial only in the long term given the high price tag attached to these interventions.

The simulation analysis shows that ROIs greater than 1.0 are possible in the short-term (i.e. until 2030) if pharmacological prices are reduced. For example, in lower middle-income and low-income countries, a reduction from 7¢ to 5¢ in the unit price per gum (NRTs) would lead to a ROI of approximately 1.0 by 2030 – if population-level cessation programmes were to be introduced simultaneously with NRTs.

Table 4 presents the net present values directly involved in estimating ROIs and a breakdown of the economic and social benefits.

Table 3. Main results (at ~2020/2021 price level)

	N	Pop (2021) million	Users 15+ (2021) million	Total cost (cum 2021-30) USD million	Avg. per capita/y USD	Quitters (2021-30) million	Cost per quitter USD	ROI (2030)	ROI (till 65y)	Lives saved (2030) million	Lives saved (till 65y) million	Avg. price USD*		
Base scenario:														
A. All interventions														
MICs and LICs	124	6,524	1,054	114,988	1.68	152	756	**0.79**	**7.50**	2.7	16.0			
Upper MICs	49	2,890	541	75,577	2.56	79	952	**0.98**	**9.60**	1.4	7.0			
Lower MICs and LICs	75	3,633	513	39,410	1.01	73	542	**0.44**	**3.44**	1.3	8.9			
A.1. Pop-level interventions														
MICs and LICs				14,313	0.21	88	164	**3.58**	**35.4**	1.4	9.3			
Upper MICs				9,957	0.34	46	217	**4.20**	**43.1**	0.8	4.1			
Lower MICs and LICs				4,356	0.11	42	105	**2.20**	**18.0**	0.7	5.2			
A.2 Pharmacological interventions												**Avg. price USD***		
MICs and LICs				101,884	1.49	66	1,553	**0.40**	**3.60**	1.3	6.8	64 (12¢)	149	170
Upper MICs				66,357	2.25	34	1,951	**0.50**	**4.60**	0.6	3.0	104 (20¢)	131	209
Lower MICs and LICs				35,527	0.92	32	1,125	**0.22**	**1.66**	0.6	3.8	38 (7¢)	161	146
												In order: NRT (¢ per gum), Bupropion, Varenicline		
Simulation:														
B. Pop-level + NRT only (ROI:1 by 2030) – NRT price reduction max at 50%												**Avg. reduction in price**		
MICs and LICs				55,864	0.82	118	472	**1.25**	**12.04**	2.0	12.5	19% (10¢)		
Upper MICs				42,262	1.43	62	683	**1.34**	**13.43**	1.1	5.5	15% (17¢)		
Lower MICs and LICs				13,602	0.35	57	241	**0.97**	**7.75**	1.0	7.0	26% (5¢)		
												NRT (¢ per gum)		
C. Pop-level + all pharmacological (ROI:1 by 2030) – price reduction max at 90%												**Avg. reduction in price**		
MICs and LICs				88,695	1.30	152	583	**1.03**	**9.70**	2.7	16.0	56% (5¢)	34%	45%
Upper MICs				70,912	2.40	79	893	**1.04**	**10.22**	1.4	7.0	39% (12¢)	20%	16%
Lower MICs and LICs				17,783	0.46	73	244	**0.97**	**7.63**	1.3	8.9	87% (1¢)	41%	73%
												In order: NRT (¢ per gum), Bupropion, Varenicline		

*Full course treatment

Note:

Population-level interventions: National quitline, brief advice, mcessation

Pharmacological Interventions: NRTs, Bupropion, Varenicline

Table 4. ROI and net present values, NPVs (at ~2020/2021 price level)

		Net Present Values (NPVs)				Net Present Values (NPVs)		
			Benefits (until 2030)				**Benefits** (until 65yrs)	
	ROI	Investment (2021-30)	Economic	Social	**ROI**	Investment (2021-30)	Economic	Social
		US$ mill	US$ mill	US$ mill		US$ mill	US$ mill	US$ mill
Base scenario:								
A. All interventions								
MICs and LICs	**0.79**	100,907	55,148	24,702	**7.50**	100,907	521,211	233,459
Upper MICs	**0.98**	66,278	44,670	20,009	**9.60**	66,278	438,952	196,614
Lower MICs and LICs	**0.44**	34,629	10,478	4,693	**3.44**	34,629	82,260	36,845
A.1. Pop-level interventions								
MICs and LICs	**3.58**	12,381	30,645	13,726	**35.4**	12,381	302,366	135,435
Upper MICs	**4.20**	8,589	24,912	11,159	**43.1**	8,589	255,390	114,394
Lower MICs and LICs	**2.20**	3,791	5,733	2,568	**18.0**	3,791	46,976	21,041
A.2 Pharmacological interventions								
MICs and LICs	**0.40**	89,567	24,839	11,126	**3.60**	89,567	222,345	99,592
Upper MICs	**0.50**	58,321	30,031	8,972	**4.60**	58,321	186,519	83,545
Lower MICs and LICs	**0.22**	31,246	4,808	2,153	**1.66**	31,246	35,826	16,047
Simulation:								
B. Pop-level + NRT only (ROI:1 by 2030) – NRT price reduction max at 50%								
MICs and LICs	**1.25**	48,915	42,345	18,967	**12.04**	48,915	406,887	182,251
Upper MICs	**1.34**	36,988	34,347	15,385	**13.43**	36,988	343,060	153,662
Lower MICs and LICs	**0.97**	11,927	7,998	3,583	**7.75**	11,927	63,827	28,589
C. Pop-level + all pharmacological (ROI:1 by 2030) – price reduction max at 90%								
MICs and LICs	**1.03**	77,785	55,148	24,702	**9.70**	77,785	521,211	233,459
Upper MICs	**1.04**	62,178	44,670	20,009	**10.22**	62,178	438,952	196,614
Lower MICs and LICs	**0.97**	15,607	10,478	4,693	**7.63**	15,607	82,260	36,845

Note:
Population-level interventions: National quitline, brief advice, mcessation
Pharmacological Interventions: NRTs, Bupropion, Varenicline

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