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COSTS, HEALTH EFFECTS AND COST-EFFECTIVENESS OF TOBACCO CONTROL STRATEGIES IN THE REPUBLIC OF MOLDOVA

By: Ghenadie Ţurcanu
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Disclaimer

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Executive summary

This study evaluates tobacco control strategies from an economic viewpoint. Interest in tobacco and cost-effective tobacco control interventions is determined by the significant impact that tobacco use has on population health and the socioeconomic development of countries.

Tobacco consumption is one of the main risk factors for death and contributes to the burden of diseases, both globally and nationally. Almost 6 million people die annually because of tobacco consumption and second-hand smoke, which globally constitutes 6% of all deaths in women and 12% in men. It is estimated that smoking causes about 71% of lung cancer, 42% of chronic respiratory disease and nearly 10% of cardiovascular disease.

International efforts to stop the tobacco epidemic resulted in the World Health Assembly adopting the WHO Framework Convention on Tobacco Control, which entered into force in 2005. The Republic of Moldova ratified the Convention on Tobacco Control in May 2007 and therefore took responsibility to make every effort in the fight against the tobacco epidemic.

The Government of the Republic of Moldova approved and implemented interventions to control tobacco, including: applying excise duties on tobacco products; banning tobacco advertising; restricting smoking in indoor locations; informing the population about the hazards of smoking, etc.

This study analyses the cost-effectiveness of tobacco control interventions and, based on the results, provides recommendations regarding implementing measures directed at improving the public health of the Republic of Moldova. This study uses the WHO-CHOICE (CHOsing Interventions that are Cost Effective) methodology and computational tool, developed by the World Health Organization and designed for the evaluation of the effectiveness and cost-effectiveness of tobacco control interventions aimed to reduce the burden of diseases. This methodology offers the possibility to estimate the impact of current tobacco control interventions applied separately and in combination, as well as quantify the maximum effect of interventions on the population health condition.

The effectiveness of an intervention is measured by the number of healthy life-years gained as a result of the intervention and which in their absence are lost as a result of premature death or reduced quality of life caused by disability. The cost-effectiveness of the intervention is measured by the quantum of financial resources in Moldovan lei (MDL) required to gain one healthy life-year as a result of intervention.

The analysis included the following tobacco control interventions: increase taxes on tobacco products; total ban on tobacco advertising; strong warnings on packaging; control of tobacco use in indoor locations; counselling; nicotine replacement therapy; and health education. The impact on health and cost-effectiveness of different interventions was modelled by quantifying the costs both at the level of individuals and at the society level, applying the prices of 2010.

Cost-effectiveness of tobacco control interventions is presented by the cost (MDL) of a healthy life-year gained or disability-adjusted life year (DALY) averted, as a result of the intervention and compared with the Gross Domestic Product per capita (20 171 MDL in 2010).

The most cost-effective interventions applied separately are: an increase in taxation from 30% to 80% of retail price, followed by counselling, brief advice, clean indoor air law, strong warnings on packaging, total ban on advertising, and nicotine replacement therapy.

Applying combined tobacco control interventions provides the opportunity to save a total of 40 487 healthy life-years each year, at a cost of 1753 MDL per each healthy life-year gained.

The results of the cost-effectiveness analysis regarding tobacco control interventions indicate that all the interventions under modelling are highly cost effective: The quantum of resources required for their implementation is less than the Gross Domestic Product per capita, and the effects produced by implementing the interventions will be much higher compared to the requested resources.

The cost-effectiveness analysis of tobacco control interventions provided reliable arguments for assisting political decisions in the field of tobacco control. The evaluation results offer suggestions for the most effective ways of improving population health indicators at the lowest cost.

Introduction

Tobacco consumption contributes to the global burden of diseases. It is the most important preventable cause of chronic diseases and deaths, which in turn are also conditioned by economic disparities, rapid urbanization and unhealthy lifestyles adopted by people in the 20th–21st century. Globally, tobacco consumption is a risk factor for six of the eight leading causes of deaths worldwide [*1*].

The burden of smoking is significant in the Republic of Moldova: about 50% of men and 7% of women smoke [*2*]. Smoking among young people is of particular concern: among pupils who have ever smoked, 49.2% started smoking before the age of ten years [*3*]. Tobacco consumption is the second leading risk factor in men in terms of the cause of the disease burden in the Republic of Moldova, constituting 14.9% of the total DALYs [*4*].

Tobacco consumption health risks result both from the direct consumption of tobacco and exposure to second-hand smoking. Of the approximately 6 million people who die in the world annually, over 600 thousand cases are attributed to the exposure of non-smokers to tobacco smoke and more than 5 million to direct consumption of tobacco [*5*].

This study was initiated due to the importance of tobacco consumption issues for society, both in the Republic of Moldova and other countries. Tobacco-related morbidity and mortality result in direct and indirect costs for society through health-care costs, reduced productivity, absenteeism from work and other direct and indirect medical and social costs.

The governments around the world are more and more aware of the negative impact of tobacco on health and the relevant costs this has on society and have become more active in approving and implementing tobacco control regulations in order to stop the tobacco epidemic.

Taking into account the limited resources available to cover direct and indirect costs imposed by tobacco consumption, it is necessary to re-evaluate the current distribution of tobacco control methods and services in order to identify the

most effective tobacco control interventions and reduce the tobacco burden on population health and welfare. With a view to achieve this objective, the Ministry of Health with the support of the Coordination Bureau of the World Health Organization in the Republic of Moldova and financial support from the European Commission carried out an analytical study regarding the tobacco control interventions in the Republic of Moldova.

The analysis is designed to obtain specific information on the possibilities to reduce the burden of diseases based on the evaluation of costs, efficiency and cost-effectiveness of tobacco control interventions. The results will be used to provide reasoning for the national policy documents in the domain of tobacco control.

The analysis was based on WHO-CHOICE methodology, elaborated by the World Health Organization for the evaluation of the cost-effectiveness of interventions on disease control. Using this methodology for the analysis of the cost-effectiveness of tobacco control interventions meant updating and contextualization of demographic and epidemiological data specific to the Republic of Moldova, as well as data on the cost of resources required to implement the interventions.

This report includes a general overview concerning tobacco consumption as an essential risk factor for health in the Republic of Moldova. The method of the cost-effectiveness analysis of tobacco control interventions used is presented along with the data collected and used for the analysis and an evaluation of the results regarding the cost-effectiveness of the interventions under analysis.

Situation analysis regarding tobacco control in the Republic of Moldova

Epidemiologic situation regarding tobacco consumption

Burden of smoking

There are over 1 billion smokers in the world nowadays. Manufactured cigarettes are the main form of smoked tobacco. It is estimated that smokers consume about 6 trillion cigarettes annually [*5*].

In 2010, smokers from the Republic of Moldova consumed 10 milliard 713 million cigarettes, which is 1.1 to 1.2 times more than in 2006–2009. Around half of the cigarettes placed in the domestic market in 2008–2009 were imported. Although within the last ten years the domestic production of cigarettes varied, it decreased till 2008 and from 2009 was attested an increase (Table 1) [*6, 7*].

Table 1. Consumption of cigarettes in the Republic of Moldova, 2000–2010

Cigarettes, million	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Domestic production	9 262	9 421	6 310	7 126	7 050	6 174	5 013	4 906.8	3 988.1	4 877.8	6 015
Import	3 329	2 348	592	1 324	1 665	2 509	3 387	4 275	4 186	4 842.3	4 926.8
Export	273	34	148	18	13	80	63	149.8	299.1	204	228.7
Internal consumption	12 318	11 735	6 754	8 432	8 702	8 603	8 337	9 032	7 875	9 516	10 713

Source: National Bureau of Statistics; Ministry of Agriculture and Food Industry

In 2010, the area of land for tobacco growing increased 1.7 times compared with 2008–2009. The share of land for tobacco growing increased from 0.17% in 2009 to 0.29% in 2010. In 2010, tobacco import also increased 1.5 times compared with 2008–2009 [*7*].

Smoking is one of the leading risk factors for noncommunicable diseases. It is associated with other factors leading to the rapid growth of noncommunicable diseases burden in developing countries, such as population ageing, the negative effects of globalization, including unfair trade and irresponsible marketing, unplanned and rapid urbanization and an increase in sedentary life. An increase in the noncommunicable diseases level related to tobacco is influenced by a high level of tobacco consumption, its availability and accessibility [*5*].

Tobacco consumption is an "epidemic" that has spread worldwide. This destructive habit has proliferated along with economic development, affecting in the beginning industrialized countries and then spreading its implacable impact towards developing countries. The tobacco industry has targeted low- and middle-income countries and vulnerable groups, such as women and young people [*1*].

Tobacco consumption creates large intra- and interpopulational disparities, disproportionately affecting some populations or population groups. Prevalence of tobacco consumption is significantly higher among men and socioeconomically disadvantaged groups. Young people are especially exposed to the risk of tobacco consumption. Poor families carry a particularly heavy burden due to tobacco consumption, with significant costs for their health, education, housing and economy. Negative social gradients of tobacco consumption transform into significant negative gradients in relation to premature deaths and diseases conditioned by it [*1*].

Prevalence of smoking

The economic effects and the health impact of tobacco consumption are directly related to the number of smokers within a population and the amount of tobacco consumed by each person. This means that both the prevalence (the share of the tobacco smoking population) and tobacco consumption (amount consumed per person) provides evidence of tobacco use in the Republic of Moldova.

Smoking among adults

Smoking was not traditionally widespread in the Republic of Moldova. However, probably because of fashion, relatively low prices for cigarettes and aggressive marketing by tobacco companies, the access to tobacco products and their consumption have increased. The results of the Moldova Demographic and Health Survey 2005 show that there are significant differences in smoking prevalence among men and women: 51% of men and 7% of women stated that they smoke. Smoking is more common among men in rural areas (53%) than in urban areas (49%) [*2*]. In the case of women, however, the situation is reversed: 2% smoke in rural areas and 14% in urban areas. In 2010, there was a certain decline in tobacco consumption among adults: men's consumption went from 51 to 34% and women's from 7 to 2% [*8*].

The share of smokers correlates with the socioeconomic status but the influence is different for men and women. A higher prevalence of smoking is recorded among men from poor households (60%) and with a lower level of education (54.1%), while in the case of women, the situation is reversed: smoking prevalence is higher among women from wealthier households and with a higher level of education. In terms of number of cigarettes smoked per day, 85% of men and 40% of women smoke ten or more cigarettes per day [*2*].

Smoking among adolescents

The rate of smoking among young people is a large cause for concern. In 2008, 13.4% of young respondents stated they consume tobacco (boys = 20.8%, girls = 7.1%), although if compared with the data from 2004, the trend is not ascending and there is even a small decrease in the number of smokers among boys (from 23 to 18.5%). For girls the data did not change very much (from 6 to 5.6%).
Among school children who have ever smoked, 49.2% started smoking before the age of 10 (54.1% boys and 40.5% girls). One pupil in ten uses other forms of tobacco consumption other than that of cigarette smoking. There are 20.3% of pupils who are exposed to cigarette smoke at home and 57% outside the home. One or both parents of almost half of pupils (47.6%) are smokers. When buying cigarettes from commercial units, two thirds of the pupils (70.7%) had never been refused them due to their age. A high number (79.6%) of pupils had tried to quit smoking [*3, 9*].

Smoking among medical students

In 2008, 65% of students of the dentistry faculties, 30% of students of the pharmacy faculties and 20% of medical college students reported that they smoke cigarettes [*10*].

Epidemic pattern of tobacco consumption

With a view to understanding the changes that occur over time in tobacco consumption prevalence, Lopez proposed a widely accepted descriptive model for determining the population level of tobacco consumption. Examining the prevalence and mortality attributable to smoking, he describes four stages of the tobacco epidemic, from the initial increase in tobacco consumption by the population to an eventual decline in smoking prevalence and smoking-related mortality. The four stages correspond to the initial increase of smoking prevalence among men, followed by the increase among women, and the increase over the course of time of the smoking-related mortality among men, followed by that among women [*11*]. According to the prevalence of smoking data presented above, it appears that smoking prevalence among adults in the Republic of Moldova has reached the maximum peak and a decline has already begun, i.e. according to the Lopez model of tobacco epidemic, the Republic of Moldova is at the end of the second stage and the beginning of the third stage.

At the population level, smoking prevalence also varies among different socioeconomic groups, undergoing modifications at corresponding levels at different stages of a tobacco epidemic.

Lopez assumes that as countries progress in a tobacco epidemic, smoking prevalence will become more evident in groups with lower socioeconomic status. At the second stage of the epidemic, smoking prevalence reaches a similar rate in all categories of the population and is potentially even higher among groups with high socioeconomic status. This situation changes at the second and third stages, when the decrease of prevalence is more evident in groups with higher socioeconomic status. The results of the Moldova Demographic and Health Survey 2005 show that there are significant differences in the inequality index with regard to smoking that depend on the level of education and economic welfare. A higher prevalence of smoking is recorded among men with lower socioeconomic status

and a lower level of education. For women, however, the situation is reversed: smoking prevalence is higher among women with a higher level of education and higher socioeconomic status [*2*].

Use of tobacco products

Manufactured cigarettes are the main form of smoked tobacco in the Republic of Moldova, but other forms of tobacco consumption are becoming more and more popular. One pupil out of ten aged between 13 and 15 years old mentioned using other forms of tobacco than cigarettes [*3*] and this is during a time when the distribution of tobacco products that cannot be smoked in the domestic market of the Republic of Moldova is prohibited by the law regarding tobacco and tobacco products [*12*].

Tobacco consumption toxicity

Tobacco products contain over 4000 chemical compounds. These substances are released into the air as particles and gases. Compounds of tobacco products affect human health, producing toxic, carcinogenic, pathophysiological and/or metabolic effects. The effects of tobacco compounds on health vary depending on the type of exposure (active or passive smoking), combination of compounds and intensity of exposure. Many toxic substances are present to a greater extent in the smoke dispersed into the environment than in direct flow, so that within a room 85% of the smoke is created by the lateral flow. This means that the lateral unfiltered flow provides nitrosamines concentrations 50 times higher than the main flow [*5, 13*], explaining the impact at a distance on a passive smoker exposed to cigarette smoke.

Health effects of tobacco

The evidence regarding the impact of tobacco on health is substantial and indisputable. The fact that tobacco is harmful for people and has negative effects on population health is not doubtful. There is a strong dose-response relationship between tobacco consumption and its effects on health. Health risks increase depending on duration and intensity of tobacco consumption. Accordingly, the

health risks associated with smoking decrease as a result of quitting smoking [*14*]. Tobacco smoking causes many diseases including cancer, respiratory diseases and vascular diseases, and it has negative effects on reproductive health [*15*].

Tobacco smoke is a multiple carcinogen. In addition to the 80–90% increase in premature mortality risk from lung cancer attributed to smoking, studies confirm that tobacco smoking also causes cancer of the inferior urinary tract (kidney, bladder), cancer of the upper respiratory and digestive tract (mouth cavity, pharynx, larynx, oesophagus), and gastric and pancreatic cancer. Tobacco is one of the causes of acute myeloid leukaemia, cervical cancer and liver cancer [*15*].

Cigarette smoke can trigger and maintain inflammation of the respiratory tract commonly seen in chronic obstructive pulmonary disease (COPD). Other mechanisms that contribute to the development and maintenance of diseases of the lower respiratory tract of smokers and passive smokers include: suppression of defence mechanisms; impairment of mucociliary clearance; and susceptibility to respiratory infections. The risk of death for consumers of more than 25 cigarettes a day is 20 times higher than that of non-smokers. Smoking also causes chronic bronchitis, emphysema, pulmonary tuberculosis, asthma and pneumonia [*15*]. The risk of developing pulmonary tuberculosis is 2.3 times higher in smokers compared with non-smokers [*16*].

Ischemic heart disease, hypertension, myocardial degeneration, aortic aneurysm, pulmonary heart disease, atherosclerosis and other vascular disease and peripheral cerebrovascular disease are among the cardiovascular diseases attributable to smoking. Smoking accelerates atherosclerotic processes, damaging the structure and function of red blood cells, platelets, leukocytes, etc.

Tobacco smoking increases the risk of reduced fetal lung function, fetal mortality, low birth weight and stillbirth. Smoking in pregnancy increases the risk of premature rupture of the membranes, premature birth and placenta praevia [*17, 18*].

Tobacco consumption is directly targeted by Millennium Development Goals (MDGs) 4 and 5 (maternal and child health), because it increases the level of adverse effects on pregnancy development and maternal health. Mothers who smoke breastfeed their children for a shorter period of time, have smaller amount of milk and their milk is less nutritious. Exposure to second-hand smoking

increases the risk of childhood respiratory infections, asthma and sudden infant death [*5, 18*].

In addition to the mentioned diseases, smoking increases the risk of cataracts, adversely affects postoperative wound healing, respiratory complications, and hip fractures, accelerates postmenopausal osteoporosis in women and incites peptic ulcer in Helicobacter pylori-positive individuals [*18*].

Burden of diseases caused by tobacco consumption

The health risks of tobacco result both from direct tobacco consumption and from exposure to second-hand smoking, which was been proved by strong evidence. Nearly 6 million people die annually because of tobacco consumption and exposure to cigarette smoke, which constitutes 6% of all deaths in women and 12% of all deaths in men worldwide [*5,18*]. Among them, over 5 million are a result of direct consumption of tobacco and over 600 000 cases are attributed to the exposure of non-smokers to tobacco smoke [*5, 13*].

According to WHO estimates at the global level, the mortality attributable to tobacco is expected to increase from 5.4 million in 2004 to 8.3 million in 2030 [*19,20*]. Most tobacco-related deaths occur in working age people. The share of tobacco-related diseases within the total burden of diseases at the global level will increase from 2.6% in 1990 to around 10% in 2015, killing more people than any other disease taken apart [*5*].

The disease burden is calculated using the disability-adjusted life years (DALY) index. DALY represents the sum of life-years lost and life-years lived in disability. The burden of disease measures the gap/difference between the current health condition of the population and the ideal situation, when every person within the population lives to old age in full health. Under this concept, in the Republic of Moldova, tobacco is the second risk factor that contributes to the total burden of diseases in men and the seventh in women [*4*] (Table 2).

Table 2. Ten main risk factors that contribute to disease burden, measured in DALY, Republic of Moldova, 2002

Men		Women	
Risk factors	**Total DALY (%)**	**Risk factors**	**Total DALY (%)**
Alcohol	27.2	Arterial hypertension	15.3
Tobacco	14.9	High cholesterol	12.9
Arterial hypertension	11.3	Alcohol	12.8
High cholesterol	8.8	Overweight	10.0
Overweight	5.6	Reduced consumption of fruit and vegetables	6.6
Reduced consumption of fruit and vegetables	5.3	Physical inactivity	5.1
Physical inactivity	3.5	Tobacco	3.2
Indoor smoke due to solid fuel burning	1.3	Unprotected sex	2.2
Illegal consumption of drugs	1.1	Indoor smoke due to solid fuel burning	1.9
Lead	1.1	Parenteral manipulations at medical institutions	1.0

Source: WHO background data (2003)

Since the effects of tobacco consumption are cumulative and take place over time, the current burden of mortality and morbidity reflects the consumption of tobacco in previous decades and not in current ones: in some countries the tobacco-related mortality is low despite the fact that there is high tobacco consumption and in other countries, where tobacco consumption decreases, mortality increases. Changes in tobacco-related mortality follow the changes in prevalence and consumption only a significant period of time (17–20 years) after tobacco consumption has been restrained [*21*].

Since men consume more tobacco than women, it is expected that tobacco attributed mortality in the medium term will remain higher among men.

According to the estimates at the global level, smoking causes about 71% of lung cancer, 42% of chronic respiratory diseases and 10% of cardiovascular diseases [*5; 19*].

Non-smokers exposed to second-hand smoking at home or work have an increased risk of more than 20% for developing cardiovascular diseases and a 20–30% higher risk for developing lung cancer. Evidence shows that there are no levels of exposure to passive smoking without risk for health [*1, 13*].

A report by the U.S. Institute of Medicine presents convincing scientific evidence that heart disease, including heart attacks, are caused by smoking (both the active and passive form of it). The authors of the report argue that even a short-term exposure to passive smoking can cause a heart attack. It is shown that passive smoking causes heart diseases, lung cancer, sudden infant death syndrome and premature childbirth. The study also reveals that organizing individual areas and smoking rooms or installing ventilation systems in rooms proved to be inefficient because they do not provide a safe level of exposure to passive smoking. The report also states that after the enforcement of laws banning smoking in public places there has been attested a decrease in the rate of heart attacks ranged from 6% to 47% depending on the study and form of analysis [*22*].

A new report by the medical journal, the Lancet, published the results of scientific research with reference to noncommunicable diseases, emphasizing that they are responsible for more than half of all deaths recorded in countries with low and medium income, surpassing recorded death cases from infectious diseases [*23*].

Up to 50% of the risk of death for men of working age is attributable to tobacco consumption. Lung cancer is the most common type of cancer in men in the Republic of Moldova, constituting 39.5 cases per 100 000 population in 2008. The mortality from lung cancer is the highest of all cancers and in 2008 it constituted 26.3% [*24*].

Within the last 10 years, mortality from noncommunicable diseases, especially circulatory diseases, cancer and respiratory diseases in the Republic of Moldova is increasing [*25*] (Figure 1).

Figure 1. Mortality of the working-age population (16–56 years for women; 15-61 years for men) in the Republic of Moldova between 1999 and 2010 (per 100 thousand inhabitants)

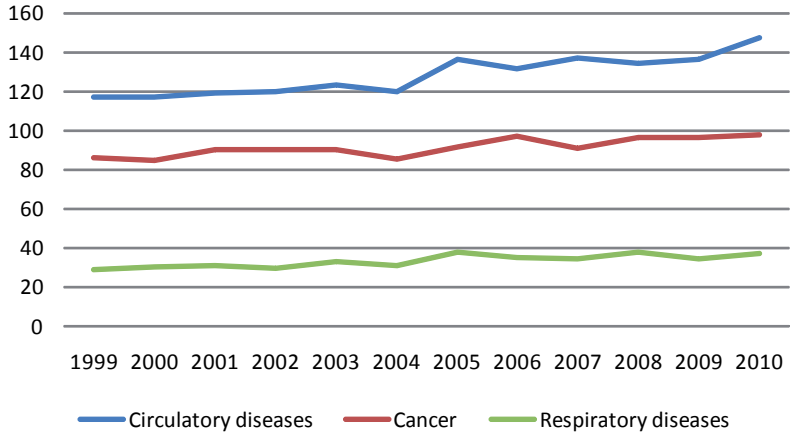
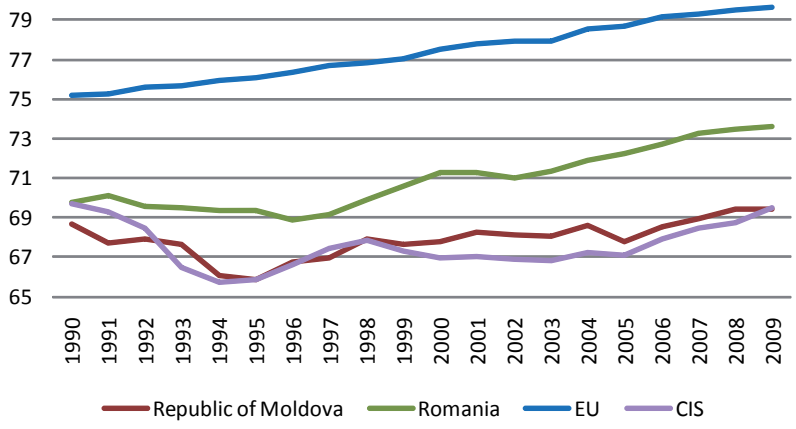


Figure 2 shows that life expectancy in the Republic of Moldova (RM) is ten years below the level of European Union (UE) countries and just above the level of Commonwealth of Independent States (CIS) countries. The life expectancy of men is 5–6 years less than women [*26*].

Figure 2. Life expectancy at birth



In a situation analysis of 22 countries with a high burden of tuberculosis, which constitutes more than 80% of the global burden, smoking was considered to be associated with 21% of cases of tuberculosis. Smoking is the cause of more than 50% of deaths from tuberculosis in India [*5*].

Alcohol also significantly contributes to the burden of diseases caused by smoking. Although alcohol is not known as a carcinogen factor, it can increase the carcinogenic effect of some substances contained in tobacco smoke, such as n-nitrosamines, therefore the exposure to both of them has a more pronounced detrimental effect than the exposure to each of them separately. Cancer of the mouth cavity, larynx and oesophagus, where there is a direct contact with tobacco smoke and alcohol, are recognized as being related to the exposure to both agents. Also, alcohol abuse and smoking increase the risk of cardiovascular diseases and affect pregnancy development adversely [*21*].

Social costs of tobacco consumption

Due to the proven effects of tobacco consumption on mortality and morbidity rates, tobacco consumption is associated with substantial costs to society. These costs can be divided into the following categories:

- direct health-care costs (medical services, medicines, etc.);
- losses in productivity (absenteeism, loss of skills, unemployment, etc.);
- welfare assurance (sickness payments, unemployment payments, home care or rehabilitation);
- fire and accidents (property loss, reckless fire);
- research and education (public health programmes, research with reference to smoking, education campaigns);
- inestimable costs resulting from pain and suffering, loss of life or tobacco-related diseases.

Health-care expenditures to treat diseases attributable to smoking are estimated at 36.6 trillion euro, which is 6% of the total health-care costs in the 27 member countries of the EU and 0.6% of the gross domestic product [*27*]. For example, in the Republic of Korea, the health-care costs of the National Health Insurance Agency related to smoking have increased by 27%, from 234.9 million US dollars in 1999 to 413.7 million US dollars in 2003, representing a substantial economic burden for the insurance system [*1*].

In 2001 in the Republic of Moldova, the health-care expenditure related to diseases caused by tobacco consumption was estimated at 360.4 million MDL or 66.5% of the consolidated budget expenditures for health care. The estimates of the economic costs of tobacco-related loss of productivity due to premature death, hospitalization and outpatient treatment of smoking-related diseases make up 430 million MDL [*28*].

Calculations made at the EU level show that a reduction of just 1% of the current smoking prevalence will result in a reduction of the direct costs of medical care related to smoking by about 90 million euro by 2017 and a reduction of indirect costs by about 108 million euro by 2027. Although the complete health benefits may be manifested over a period of up to 30 years, major improvements, especially in terms of respiratory and cardiovascular health, may occur in the first 5 years [*27*].

The economic consequences of smoking are also significant for employers, including: reduced productivity of workers due to smoking breaks and increased sickness absence; damage caused by fire due to smoking products; and costs related to cleaning and redecorating to eliminate the effects of smoke. In Canada in 1995, the annual cost for an employee who smoked compared with a non-smoking one, was estimated at 2565 Canadian dollars. The losses registered in 1997 by Scottish employers due to lower productivity, higher rates of absenteeism and accidental fires caused by smoking were estimated at 0.51 and 0.77% of the Scottish Gross Domestic Product. In Ireland in 2000, a similar evaluation registered losses between 1.1 and 1.7% of the gross domestic product [*27*].

Tobacco control policies

WHO Framework Convention on Tobacco Control

The Republic of Moldova signed the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) on 29 June 2004 and ratified it by Law no. 124 of 11 May 2007 on the ratification of the Framework Convention of the World Health Organization on Tobacco Control [*29–30*]. Official ratification documents were filed to the United Nations on 3 February 2009 and the Treaty entered into force for the country on 4 May 2009.

The objective of WHO FCTC is to protect present and future generations from the devastating consequences on health, environment and economy of tobacco consumption and exposure to tobacco smoke. The Convention also requires parties to develop and implement strategies, plans and comprehensive multisectoral national tobacco control programmes, without being influenced by commercial interests and other veiled interests of the tobacco industry. Such strategies, plans and programmes must take into account the need to adjust the national policies to the European legislation on tobacco control, as a part of the integration process of the Republic of Moldova into the European Union. At present, the Government of the Republic of Moldova is negotiating with the European Commission on the future Association Agreement.

National legislation in the domain of tobacco control

Law regarding tobacco and tobacco products

The Republic of Moldova adopted Law no. 278 of 14 December 2007 on tobacco and tobacco products [*12*], which is partially in harmony with Directive 2001/37/EC of the European Parliament and Council on the approximation of legislative acts and administrative acts of Member States concerning the manufacture, presentation and sale of tobacco products [*31*]. The above mentioned Law establishes the basis for implementation of certain measures stipulated by the WHO FCTC, including:

- protection of economic interests of the state and society in agricultural and industrial sectors of tobacco, in the domain of tobacco products import and marketing;
- creation of adequate conditions for the production of unfermented and fermented tobacco and tobacco products;
- introduction of measures to limit tobacco products consumption;
- providing information to consumers about purchased and consumed tobacco products;
- regulation of smoking in facilities and public spaces;
- combating and control of counterfeit tobacco products; and
- introduction of measures to prevent hazardous effects of tobacco on health.

With regard to the tobacco control domain, the Law stipulates requirements for:

- the content of harmful substances in tobacco products;
- the presentation and labelling of tobacco products, including application of general and secondary warnings on the hazards of smoking on health and obligatory notice on the content of harmful substances;
- compulsory annual reporting to the Ministry of Health;
- the restriction on advertising, promotion and sponsorship;
- a ban on the sale of tobacco products that cannot be smoked and also those with the content of harmful substances exceeding the maximum admitted level or without warnings regarding the hazard of smoking;
- the sale of tobacco products;
- restrictions regarding smoking in public places;
- state control in the domain of tobacco; and
- liability for legislation infringement.

Although the law introduced important measures to control tobacco, which correspond to the requirements of the Convention, it will be reviewed and amended with a view to achieving full compliance with the requirements of the Treaty, in particular with regard to general obligations (Article 5), price and taxation aimed to reduce the demand for tobacco products (Article 6), protection against exposure to tobacco smoke (Article 8), measures to reduce tobacco addiction and quit smoking (Article 14), combatting illicit trade in tobacco products (Article 15), research, surveillance and exchange of information (Article 20), and harmonization with EU legislation that is already in force.

Although the Law 278/2007 has been in force for over three years, its provisions have only been partially implemented.

In 2012, the Ministry of Health is planning to review the Law on tobacco and tobacco products by drafting two separate laws, one of which will specifically regulate tobacco control measures and the other will be focused on the tobacco production sector (as appropriate). The new law on tobacco control will clearly stipulate tobacco control measures in accordance with the WHO FCTC and the European Union legislation in force in this domain, clearly delimiting functions and responsibilities and identifying resources for the law enforcement and effective mechanisms for its monitoring and implementation.

Law on advertising

This law allows advertising of tobacco products under certain conditions, including the marketing of tobacco products. It only prohibits sponsorship of broadcasting programmes and not other events that might potentially promote tobacco consumption [*32*].

Contravention Code

The Contravention Code of the Republic of Moldova no. 218 of 24 October, 2008 only stipulates sanctions for the following infringements of the law: selling tobacco products to minors; smoking in prohibited places (art. 91); and smoking in public transport (art. 203, paragraph 3). The above-mentioned legislative act will be modified and amended within the framework of the review of the current legislation on tobacco and tobacco products, with regard to the introduction of penalties for all types of infringements of the legislation in the domain and designation of authorities responsible for their detection and application of sanctions [*33*].

Tax code

Taxes on tobacco products are established annually by modification and amendment of the Tax Code [*34*]. Current taxes, which are levied in the form of taxes for tobacco, are very small and do not discourage tobacco consumption.

In 2008–2009, the taxes on tobacco products in the form of a percentage from price constituted 22%. Although in 2010 the taxes for tobacco products were increased up to 30%, the Republic of Moldova remains the country with the lowest prices for cigarettes in Europe: they range from US$ 0.3 for the cheapest local brands without filter up to US$ 2.2 for the most expensive brands of imported cigarettes (Table 3).

Table 3. Dynamics of excise duties for tobacco products in the Republic of Moldova, 2008–2011

Years	*Excise duty rate for 1000 cigarettes*	
	with filter	**without filter**
2008	6.0 lei :	4.4 lei
2009	6.6 lei +3%	4.8 lei
2010	6.6 lei +12%	7.0 lei
2011	10 lei +18%	10.50 lei

Source: Tax Code, Ministry of Finance

On 15 July 2011, the Interministerial Committee for Strategic Planning under the Government of the Republic of Moldova considered and approved the draft of the medium-term budgetary framework (2012–2014), which provides for gradual adjustment of excise duty rates on tobacco products to the level existing in the countries of the region and to European practice in the years 2012–2014, as shown in Table 4.

Table 4. Increase of the excise duty rates for tobacco products planned in 2012–2014, the Republic of Moldova

Tariff position	*Unit of measure*	*Excise duty rate*			
		2011	**2012**	**2013**	**2014**
		current	**expected**		
Cigarettes with filter	Value in lei, MDL	10 lei + 18%	40 lei + 27%	80 lei + 36%	120 lei + 45%

Source: Draft budgetary framework for medium term (2012–2104)

National Health Policy

The National Health Policy approved by the Government Decision no. 886 of 6 August 2007 contains a separate chapter dedicated to the control of three behavioural factors that have a high risk for health: consumption of tobacco, alcohol and illicit drugs. This control will be implemented by applying intersectoral measures. The National Policy stipulates implementing some interventions in the

domain of tobacco control, such as: the prevention of exposure to tobacco smoke at work, in public transport and in other places; a ban on advertising, promotion and sponsorship of tobacco; measures to prevent the marketing of tobacco products to minors; measures on information and education of the population, carried out in collaboration with civil society, communities, and educational and medical institutions; and the introduction of various mechanisms to help smokers quit smoking [*35*].

Although the National Policy has been in force for over three years, only a few of its provisions have been implemented and/or executed. Most of its components will be introduced into legislation and/or their implementation will be strengthened in order to effectively combat tobacco consumption and prevent tobacco use by young people.

National Programme for Promoting a Healthy Lifestyle

Some aspects of tobacco control are included into the National Programme for Promoting a Healthy Lifestyle, approved by the Government Decision no. 658 of 12 June 2007, which provides for some measures on health education and health promotion, in particular, prevention of smoking among young people and protection against the exposure to tobacco smoke [*36*].

National Tobacco Control Programme (draft)

Within the period of 2010–2011, the Ministry of Health with support from WHO has developed a draft National Tobacco Control Programme, which reflects the requirements outlined in the WHO FCTC and is submitted to the Government for approval. The draft of the Programme includes measurable objectives with regard to the impact of a reduction of tobacco on the population health and also includes actions designed to achieve these objectives [*37*].

Alongside this Programme, the National Coordinating Council on tobacco control will be established with the view to coordinate intersectoral implementation of measures stipulated by the National Programme.

Aim of the study

The Framework Convention on Tobacco Control calls on the Member States to adhere to its principles and the Programme of Tobacco Free Initiative provides support to them with a view to implementing tobacco control measures under the provisions of the Convention.

WHO-CHOICE is a tool created and offered by the World Health Organization to Member States to provide evidence to policy makers on the best interventions and health programmes in the context of available resources.

There was a need to analyse measures on tobacco control that were already undertaken by the state, to evaluate the effects of new measures and to determine the most cost-effective interventions for reducing the burden of diseases caused by tobacco. The Ministry of Health with the support of the Coordination Bureau of the World Health Organization in the Republic of Moldova initiated the study of the medical and socioeconomic quantification of measures that are aimed to reduce tobacco consumption in the Republic of Moldova.

The aim of the study was to evaluate the efficiency and cost-effectiveness of tobacco control interventions in the Republic of Moldova.

With a view to achieving this objective, the methodology developed by the World Health Organization for estimating the cost-effectiveness of control measures concerning disease burden (WHO-CHOICE) was used. Regional information was adjusted to the national level. This report contains recommendations for intervention policies in the domain of tobacco control in the context of the current epidemiological situation and analysed interventions.

Methodology of the cost-effectiveness analysis regarding tobacco control interventions

WHO-CHOICE methodology

Cost-effectiveness analysis (CEA) of interventions to control diseases and their determinants is a method widely applied in the field of health economy, which quantifies the required resources in monetary units in order to obtain results in terms of natural indicators, for example, the number of healthy years of life gained, cases of disease averted or objectively measured quality of life improvement. Cost-effectiveness analysis regarding tobacco control interventions and harmful alcohol consumption based on the WHO-CHOICE methodology was used in some countries in Eastern Europe such as Estonia [*38*].

Cost-effectiveness analysis is used in studies to determine the disease burden with a view to comparing the resources required to implement various interventions that will improve population health and reduce the disease burden. Total gain in health and the resources required to achieve such a change are calculated for each separate intervention. Cost-effectiveness analysis offers explanations regarding the relationship between the improved health condition and economic results of the intervention [*20*].

Defining the public health problem is the first stage of the cost-effectiveness analysis regarding the reduction of disease burden: what should be changed, why and when? Possible interventions are determined: what tools and actions should be applied to achieve the target and which of the measures are the most effective and suitable for this purpose?

The resources required to implement the intervention are evaluated at the second stage. Costs are analysed from the point of view of society. Conventionally, only additional actions and costs required to implement interventions that are supplementary to already existing operational activities and resources that have been spent are considered. WHO-CHOICE methodology involves estimating the

cost of each intervention, both at the programme and patient levels, each of them being compared with the situation of non-intervention.

The third stage of analysis involves presenting the obtained change in the health condition of the population, expressed in life-years lived in full health, as a result of different interventions. This takes into consideration the increase in the number of years lived in full health, the number of years lived with disease, quality of life improvement without the increase of the number of life-years and possible negative effects.

Cost-effectiveness of an intervention depends on the number of years of healthy life gained and the cost of a life-year gained. One of the most cost-effective interventions is vaccination against infectious diseases (mumps, rubella, diphtheria); where vaccination costs are ten times lower than the avoided costs for treatment, not to mention the prevention of the huge loss of health.

The methodology of cost-effectiveness analysis has not previously been widely used to determine national health priorities mainly because of the limited validation of different methodologies, issues related to data availability and the reduced possibilities of generalizing the results of studies [*39*]. Recently, with a view to approaching this issue, the World Health Organization has initiated an elaboration of some methods to help to determine cost-effectiveness that can be used on a national level.

WHO-CHOICE simplifies the use of cost-effectiveness analysis, standardizes the approaches used by the Member States and ensures comparability of data [40]. However, it should be noted that the principle of cost-effectiveness is just one of the criteria for decision-making [*41*].

The results of applying WHO-CHOICE can be used as arguments in defining health-care priorities. This methodology is based on a so-called "generalized" approach in order to avoid the limits of economic studies carried out in specific contexts. On the other hand, when selecting an intervention to solve a specific public health problem within a certain period a more detailed analysis of the cost-effectiveness index is usually required [40].

The theoretical advantages of the results of WHO-CHOICE are related to several major features. First, all interventions are evaluated in comparison with the

situation of "doing nothing": all interventions are compared with the situation where there is no control interventions regarding the disease or risk factor, allowing both current interventions and new ones to be evaluated. This approach means that both the cost-effectiveness of an individual intervention as well as a combination of interventions with each other can be evaluated [*42*]. Second, the impact of an intervention is modelled for a period of 100 years, where the intervention itself is being implemented only within a period of 10 years. At the end of the intervention, the previous trend is taken and used in modelling the change in the population health condition for the next 90 years [*43, 44*]. Third, the intervention effects are expressed in disability-adjusted life-years (DALYs) averted (which can be seen as the inverse of the healthy life-years gained). Fourth, the calculation of costs is made based on the approach "per ingredient", so the quantities of resources required for starting and maintaining intervention programmes are quantified separately from their respective prices or cost units. In this study, the intervention costs obtained using this approach were discounted by a rate of 3% and are presented in lei (MDL) (1 euro = 16.30 MDL).

The results of analyses carried out in different regions of the world within the framework of WHO-CHOICE are collected into a unified database, which does not differentiate information on a particular country located in the region. In the regional context of WHO-CHOICE, the Republic of Moldova belongs to the Eur C sub-region along with the Russian Federation, the Ukraine and other countries. Data regarding cost-effectiveness in the region can be found on the WHO-CHOICE methodology web site: http://www.who.int/choice. Collected information allows interpolation of results by the country in accordance with the regional average values with regard to demographic, economic and morbidity and mortality indices, and the difference between country indices and the average values for the region.

Interpolation data can be used to specify the cost-effectiveness of the country-related interventions. Specification and harmonization to the local situation is carried out by means of contextualization. Within the process of contextualization, there are corresponding prepared electronic tools for each risk factor. These tools include formulas for modelling the prevalence of risk factors involved in disease burden, and data related to the intervention, which are based on the interpolation results for the given region.

Determining the intervention impact

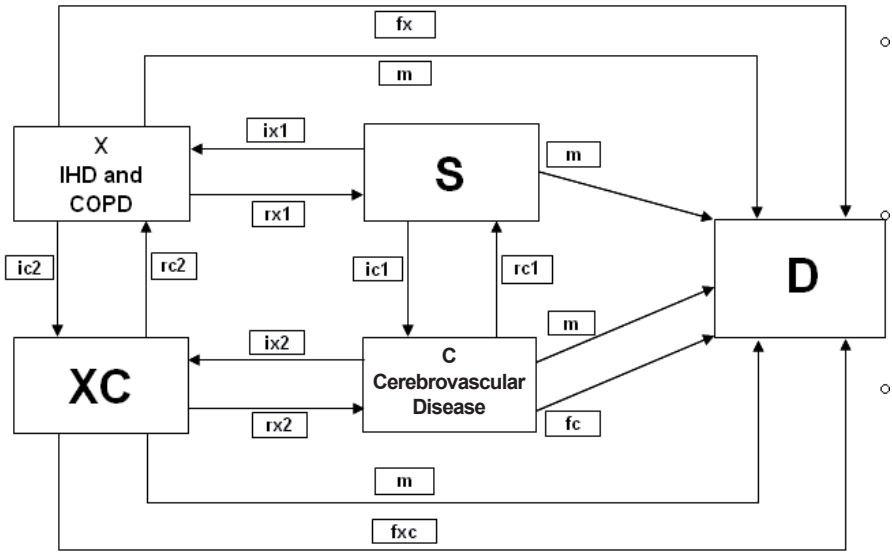
The first step to follow while calculating the intervention impact is to determine the health hazard produced in the event of non-intervention, i.e. determine the health status of the population without any tobacco control. Mortality, morbidity, prevalence and other epidemiological indices will differ from those characteristic of the current situation in the event of intervention absence. Such differences in the epidemiology of diseases lead to the formation of a different structure of population health.

The current situation is used as a starting point for establishing the null situation and the process of obtaining it, mostly determined by the set of currently applied interventions. For example, if the intervention is preventive in nature, the change may influence the incidence or case-fatality associated with the disease(s) in question; however, if the intervention includes treatment, then the disease duration may shorten and quality of life of the patient will improve, which will lead to the reduction of health losses of the population [*44*].

Determining the impact of specific interventions is based on the natural course of untreated cases, clinical studies and expert evaluations. The first two possibilities are limited to developed countries because of ethical obligations not to avoid treatment, if any, and, therefore, the evaluative determination of the intervention impact is used more frequently.

The current epidemiological indices rise according to the impact of the intervention. For example, if intervention reduced the morbidity of a disease by 7%, then to determine the null situation, it is implied that the current measurements of morbidity increased by 7%. After determining morbidity, prevalence, fatal cases, disease duration and mortality in a situation of non-intervention, the data are used to determine the population health loss for the situation of non-intervention, and also for situations resulting from the interventions by applying the population model PopMod [*45*] (Figure 3).

Figure 3. Population model PopMod



X = "those with Ischaemic heart disease and Chronic Obstructive Pulmonary Disease"
C = "those with Cerebrovascular disease (Stroke)"
XC = "those with both X and C"
S = "susceptibles", i.e. those without X or C
D = "dead"
ix = incidence of IHD and COPD
rx = remission from IHD and COPD, assumed to be 0
fx = fatality hazard due to IHD and COPD
ic = incidence of Stroke
rc = remission of Stroke, assumed to be 0
fc = fatality hazard of Stroke
fxc = fatality hazard of both IHD, COPD and Stroke
m = "background mortality", excluding fc, fx and fxc - this transition rate is used to model changes in lung cancer mortality

PopMod imitates the evolution in time of an arbitrary population subject to births, deaths and two different disease conditions. The population model is divided into male and female subpopulations, which are divided into age groups with an interval of one year. For assessing the impact of current and potential interventions for enhanced tobacco control, we use the Smoking Impact Ratio (SIR) as a composite index for assessing the cumulative/lifetime health risks of

smoking (since current prevalence may underestimate the burden associated with past exposure levels), and relate changes in the SIR to corresponding expected changes in underlying levels of three diseases: ischaemic heart disease, chronic obstructive pulmonary disease (state X in the schema above) and cerebrovascular disease or stroke (state C). In a similar way, the downstream mortality effects of reduced rates of lung cancer are modelled via a change in the background mortality rate in the population (hazard m in the schema above).

Within the framework of analysis, two basic scenarios were modelled for a period of 100 years: the first scenario without any interventions, for example, in the case of natural development, and the second scenario with the impact of the interventions under study over the natural course of morbidity for a period of ten years (after which the epidemiological rates of the natural course are restored). The difference between these two scenarios shows health benefits resulting from interventions expressed in healthy life-years gained. The result obtained in life-years gained is reduced by applying the discount rate of 3% and the number of years lost is balanced by age-weights; this is the rule applied by WHO in the WHO studies with regard to global burden of diseases and studies with regard to risk burden [*46*].

The reason for applying the discount rate and age weighting is conditioned by the increase of the socioeconomic dimension of the interventions' impact. Reduction of the result value in time is a common method used in economic analyses with a view to ensuring the link between disease burden dynamics and economic outcomes of it, as well as to analyse the cost-effectiveness of the long-term investment. Age weighting gives different value to years of life lost at different ages and is based on the generally accepted opinion that gives preference to years lived as a young adult, compared to those lived as an elderly person or child.

The population model used contains up to five sections that allow simultaneous modelling of up to two diseases and their additional combination in healthy people and those who died.

In addition to the above-mentioned epidemiologic indices, the health loss modelling includes using a general structure of population and mortality (by age groups for each), total number of births and disability share for different conditions of the model.

Consequently, PopMod allows evaluation of the improvement of the population health condition (or avoided burden of diseases) as a result of interventions, compared with the situation when nothing is done.

Determining the intervention cost

Principles of cost evaluation

Estimating the cost of interventions in the WHO-CHOICE methodology is based on three important principles: a common approach to all costs for all interventions; a bottom-up approach to the elements of a cost, quantifying costs at the level of a resource unit; and calculating all economic costs (as opposed to financial ones).

Having an identical approach towards a large number of diseases and intervention costs regarding these diseases, by implementing the same methodology and analytical assumptions, greatly increases the comparability of the analysis results and general use of the results. For example, it allows a comparison of interventions that are targeted at completely different diseases, which until now was a challenging operation [*47*].

WHO-CHOICE has implemented an approach to cost elements, including, bottom-up resource evaluation, in order to distinguish the quantity of resources used and the unit cost of resources. This approach allows a more flexible description of total costs compared with a top-down approach, where the cost components are determined based on the total estimated cost.

Another essential principle in determining the cost of WHO-CHOICE interventions is economic perspective; that is, an attempt is made to assess the 'opportunity cost' while using various resources, such as human resources, during the intervention, which is calculated in reference to its next best use. Often these opportunity costs can be well approximated by prevailing financial costs (e.g. the salaries of health workers).

Within the framework of the present analysis, the costs were estimated for the whole society. The applied model does not indicate the sources for covering the following costs: state budget, compulsory medical insurance funds, contribution of patients or other sources of coverage. According to the same principle, the analysis does not describe the change in monetary tax paid to the state treasury from interventions, including changes in taxation, because from the point of view

of society it is only the location that has changed and not the amount of resources. When compared with financial costs, only strict monetary expenditures of the resource users were taken into account and the intervention burden on society as a comprehensive whole may not be apparent.

Division/distribution of the unit cost for resources and prices

Implementation of various interventions involves the use of various resources. The WHO-CHOICE model provides for the separation of resources depending on their input, type of cost, domain and time of implementation, level of the implementing organization and origin of resources. To ensure comparability of data, the model provides an additional classification with international comparisons, where the exchange rate is applied.

Resources (costs) are divided into recurrent (personnel costs, utilities, transportation costs, per diems for training, etc.) and lump-sum expenses (purchase of buildings, transport facilities etc.). The initial costs and maintenance costs of the intervention are estimated.

Depending on the type of costs, they were divided into fixed and variable costs. Fixed costs include costs required to initiate the programme and maintain its operation and do not depend on the number of people employed (costs for central administration, activities monitoring, adaptation of legislation). Variable costs depend on the number of people involved in the programme implementation (people ensuring communication with target groups or people employed to monitor the progress of the programme, costs related to warehouses premises etc.).

Depending on the domain of implementation, costs were divided into costs for planning, administration, media coverage, training, monitoring, etc.

Depending on the period of time, WHO-CHOICE distinguishes costs required for the project initiation and those required to maintain its progress. These two periods of interventions are delimited as, on average, the preparatory costs can be much higher than the costs related to the maintenance of the project progress.

It is important that start-up costs are partially distributed throughout the whole period of intervention in a form of annual reduction/discount.

Required costs and resources vary depending on the scale of intervention, so it is important to differentiate the costs depending on the level of organization. Such levels can involve administrative units (country, district, etc.) as well as different institutions providing medical services (medical institution, patient level, programme or healthcare system level, local or regional hospital).

In accordance with the above principles and differentiation of required resources, WHO-CHOICE has developed a software package that sums up the costs of interventions using a program called CostIt (Costing Interventions templates), which consists of several Microsoft Excel templates [*48*].

The software CostIt is designed to analyse and economize data related to costs. It is not a tool for data collection, but can be used as a model for developing a primary data collection system.

CostIt is used to calculate the economic costs of the intervention, but essentially it can also be used to calculate the financial costs of the intervention.

Although the impact of each intervention is determined separately, it is possible to combine costs of different interventions. The availability of this option is very important so that an accurate analysis of the real situation can be obtained.

While analysing the cost of combined interventions, the common part of all interventions can be determined and, where possible, the distribution of costs between the interventions can also be determined. In the WHO-CHOICE model, the most frequent common part of interventions is the working time of the managerial staff. A share of the time period spent in an office and the distance covered in transport is also a frequent common part of interventions. The use of resources rating is possible only if a unit of resources is clearly defined in real life, for example, the price of a vehicle, of which perhaps 20% is covered by an intervention.

In addition to rating resources, CostIt allows consideration of the actual scale of their use. The resource use can be defined as the proportion of productive time of the total working time and direct costs related to these resources in terms

of buildings, equipment and employees. For example, while analysing hospital costs, the cost of a hospital bed varies depending on the time of the bed use.

The CostIt package allows you to specify different utilization rates with regard to WHO-CHOICE interventions. It creates opportunities to more accurately assess the costs of interventions and to find ways to avoid expenditure by improved use of resources, therefore, interventions become more cost effective.

An important part of determining the total cost of an intervention is adding up the different costs at different levels. The necessary resources and the prices for different levels are described in the intervention plan for a typical region.

Total costs depend on the intervention scale. When calculating the costs of an intervention, the WHO-CHOICE tool does not offer the possibility to quantify the benefits obtained from labour productivity growth as a result of decreased health loss of the working age population.

Interpreting results

Applying WHO-CHOICE methodology offers the opportunity to determine both the average and incremental cost-effectiveness of interventions. In the case of average cost-effectiveness, interventions are each compared to the null scenario of no intervention. By comparison, incremental cost-effectiveness identifies the additional cost that must be paid in order to obtain one extra year of healthy life, relative to other interventions already shown to be more cost effective [40].

In terms of implementation, interventions can be mutually exclusive or used simultaneously. Each decision with regard to launching an intervention must begin with the question of whether the intervention can be implemented simultaneously with another intervention or not. In the case of tobacco control, the increase of tobacco excise duties and a total ban on smoking indoors are examples of two simultaneously implemented interventions that can be done at the same time. However, simultaneous implementation of various intervention principles is not always possible.

Cumulative cost-effectiveness evaluation is best shown in the graphical presentation of cost and effect, where costs are placed on the vertical axis and

effects on the horizontal one. In this case, the cost-effectiveness is indicated by the inclination angle traced from the zero point of axes and the intersection point of cost and effect axis. The smaller the inclination angle is, the more cost-effective the interventions because the positive changes in health are achieved with the lowest costs.

Figure 4 shows a hypothetical situation of interventions A, B, and C and lines indicating their cost-effectiveness from ***a*** to ***c***. Based on a cost-effectiveness analysis of a single intervention, the intervention that should be chosen is the one with the smallest angle of inclination. In the given example, intervention A is the best choice followed by intervention B and finally by intervention C.

Figure 4. Costs and benefits of mutually compatible interventions

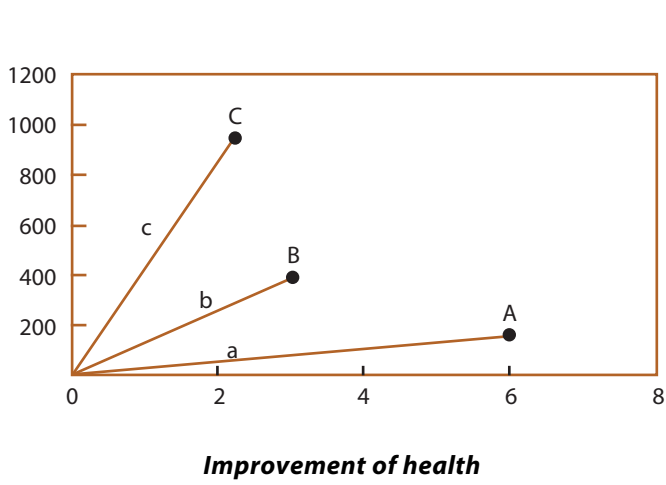
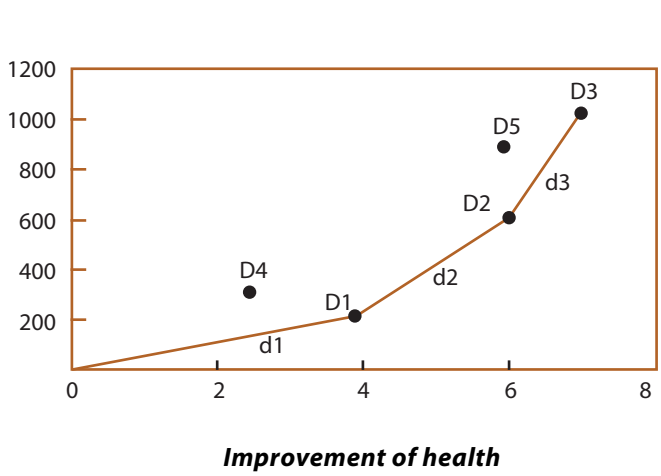


Figure 5 shows another hypothetical example of interventions D_1–D_5, which are mutually exclusive (they mutually exclude each other). A linear graph shows that the most cost-effective intervention is intervention D_1, followed by the second most cost-effective intervention D_2. However, intervention D_2 cannot be implemented simultaneously with intervention D_1. Therefore, their costs and effects become irrelevant, but the cumulative cost-effectiveness becomes important.

Figure 5. Costs and benefits of mutually exclusive interventions

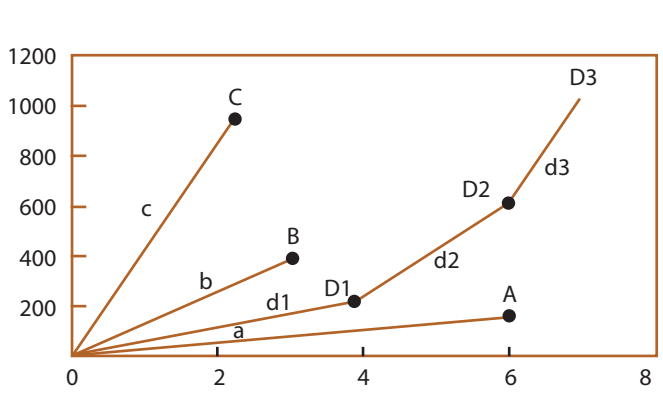


Additional costs and effects shown in Figure 5 are indicated by line ***d***. Therefore, in the case of non-simultaneous interventions, the selection of the next intervention depends on the level reached by the previous intervention. In Figure 5, intervention D_1 is followed by interventions D_2 and D_3, which altogether form the extension path of interventions, and which would be the best combination of interventions for different levels of resources.

Interventions D_4 and D_5, also shown in Figure 5, are not part of the selected combination and they will not be selected if cost-effectiveness is the only choice criterion for interventions. This is because when they are compared with interventions placed on the extension path, they are the least cost effective. In real life, the decision-making process is also influenced by other circumstances, for example, various social and ethical conditions.

The above-mentioned rules for selecting interventions can be combined only if the examined interventions include both the interventions that can be implemented simultaneously and the mutually exclusive ones. Figure 6 is a hypothetical example showing such a situation. The applied principle is still selecting the interventions with the lowest angle of inclination. In this case, the inclination angle traced from the zero point of axes (medium proportion of the cost-effectiveness) is compared to previously selected interventions (proportion of cumulative cost-effectiveness).

Figure 6. Cost and benefit of mutually compatible and mutually exclusive interventions



In this example, the first selection is intervention A. According to cost-effectiveness analysis, the next choice is intervention D_1 as, when compared to others, the inclination angle d_1 is the smallest. To select the third intervention, the inclinations of lines ***b*** and ***c*** are compared with the inclination of d_2, which represents substituting intervention D_1 with D_2. Since the line ***b*** has the smallest inclination angle, this means that intervention B is selected. Following the same logic, the next interventions to be selected are D_2, C and D_3.

Dividing interventions into cost effective and cost ineffective depends on society's values and the generally accepted limits on which an evaluation of the values is based. In accordance with the recommendations of the WHO Commission on Macroeconomics and Health, such a division can be done based on the gross domestic product (GDP) per capita. In 2010, in the Republic of Moldova this was 20 171 lei [*6*].

According to these recommendations, WHO-CHOICE distinguishes between:

- highly cost-effective interventions - the cost of a healthy year of life gained is less than the gross domestic product per capita (less than 20 171 lei);
- cost-effective interventions - the cost of a healthy year of life gained is between 1 and 3 times the gross domestic product per capita (20 171–60 513 lei); and

- cost-ineffective interventions - the cost of a healthy year of life gained is more than 3 times the gross domestic product per capita (over 60 513 lei).

Contextualization

WHO-CHOICE methodology was initially used for the analysis of cost-effectiveness at the level of global regions and its results were used to interpolate country-specific results. With a view to obtaining results as much as possible adjusted to the local situation, initial data necessary for contextualization is specified. In the present study, this involves the following conceptual sections:

- familiarization with the methodology;
- collection of input data;
- evaluation of the data validity by a focus group and their updates in accordance with the focus group recommendations; and
- data analysis and presentation of the results.

The Ministry of Health in cooperation with WHO organized a seminar on cost-effectiveness analysis, WHO-CHOICE methodology and tools available and the possibilities of contextualization. During the seminar, which was held in April 2011, Dan Chisholm from WHO and Taavi Lai from the Department of Public Health, University of Tartu presented information on the above-mentioned topics.

The two-day seminar aimed to give information about the basic theoretical aspects of the WHO-CHOICE method and tools and about country-specific data. WHO-CHOICE contextualised data has been developed to evaluate interventions that are targeted at reducing alcohol and tobacco consumption and exposure to tobacco smoke, as well as their impact on health. This contextualised data is described in the present report.

Epidemiological data

Demographic data used for the analysis are based on official demographic data provided by the National Bureau of Statistics [*6*]. In accordance with these data, the population structure by sex and age, number of live births and the mortality rates by age and sex groups were specified for the PopMod population model.

The main initial data for the model were the prevalence, incidence, disease remissions and mortality per 1000 people, and estimates of the diseases burden caused by tobacco. The main sources of information came from the databases of the National Center for Health Management and the National Health Insurance Company and if national data were not available, specialized scientific literature was used.

Epidemiological data on smoking prevalence were taken from the Moldova Demographic and Health Survey 2005 [*2*], a study regarding the population's access to health services (preliminary data offered by the National Bureau of Statistics [NBS]); the Global Youth Tobacco Surveys, Ages 13–15, 2004 and 2008 [*3, 9*]; as well as from a survey regarding smoking among medical college students, 2008 [*10*].

Nicotine gum costs were calculated based on sales prices in the domestic market of medicines. Programme costs, such as resources required for management and implementation of the interventions, staff training and media coverage were obtained from the Ministry of Health, the governmental body responsible for administrative interventions and surveillance in the domain of public health in the Republic of Moldova.

Disability weight

According to WHO-CHOICE methodology, the efficacy of interventions is expressed in averted health losses. This is determined in accordance with the data on the prevalence of conditions and indices that describe the severity of conditions.

The severity of a condition is expressed by the reduction of the quality of life of a person caused by the disease, i.e. the disability weight. The disability weight, according to the severity of the condition, varies between 0 (perfect health condition, without any loss of quality of life) and 1 (worst health condition imaginable, 100% loss of quality of life).

In accordance with data from The Global Burden of Disease, 2004, in the original model, the disability weight varied between 0.944 and 0.607 in men and between 0.954 and 0.633 in women. According to WHO-CHOICE evaluation, the disability weight for ischemic heart disease (IHD) and chronic obstructive pulmonary

disease (COPD) varies between 0.557 and 0.692 in men and between 0.557 and 0.631 in women, increasing with age. In the case of cardiovascular diseases, the disability weight is 0.453.

Interventions and their effectiveness

According to WHO-CHOICE methodology, an intervention is any action that makes it possible to decrease or avoid health losses caused by the analysed conditions.

An intervention is included into analysis if according to the international literature sources there its efficacy in decreasing of health losses has been proved, and its effects on population or population groups are considerable and it allows high coverage of the target group.

The following types of interventions have been evaluated, targeted at reducing the incidence and prevalence of tobacco consumption, resulting in a decrease of the incidence of diseases related to tobacco consumption, such as IHD and COPD, cerebral stroke and lung cancer:

- increasing taxes on tobacco products;
- total ban on tobacco products advertising;
- total ban on smoking indoors;
- labelling/information;
- nicotine replacement therapy;
- brief advice in primary care; and
- counselling.

The above interventions were evaluated separately and in combination.

Increasing taxes leads to higher prices for tobacco products and therefore decreases the consumption of these products, which significantly influences the demand for tobacco products. The effect of taxation, and consequently of price change, on consumption is estimated based on the information regarding price elasticity (change in consumption produced by the increase of price by 1%) towards demand for tobacco products. According to the World Bank estimates, the increase of tobacco products price by 10% reduces tobacco consumption by 4% in developing countries, thus averting 3% of all deaths attributable to tobacco

[*49*]. The increase of prices for tobacco products contributes to the reduction of tobacco consumption, especially among young people. Under the WHO-CHOICE model, the price elasticity value constitutes 0.88 for people aged 15–30 years and 0.7 for people aged over 30 years.

Modelled interventions include currently applied taxes. In 2010, when the study was initiated, there was an increase in taxes by 8% in comparison with 2008, i.e. from 22% up to 30% of the retail price for tobacco products. Since the Republic of Moldova has the lowest taxes, and consequently, prices for tobacco products in the region, an increase in the level of the illicit trade in cigarettes in the country is unlikely.

A total ban on tobacco products advertising will have significant effects on tobacco products consumption. A modelled situation indicated there would be a reduction in the incidence of smoking by 5%.

As far as the clean indoor air legislation goes to protect the population from smoking, estimates taken from scientific literature were used [50] that show a reduction of 29% in tobacco products consumption, conditional on a strict enforcement of the law. Assuming that currently 35% of smoking occurs in indoor public places, the enforcement of legislation totally prohibiting indoor smoking will decrease the potential incidence of smoking among men by 2.1% and among women by 0.1%.

Nicotine replacement therapy, applied to 50% of adult smokers (15–59 years), will, according to the estimates, reduce the incidence of smoking by 6.1% [*51*].

Counselling may have an efficacy of 9.4% in reducing the incidence of smoking and short messages of 6.8% [*51*].

Among the analysed interventions, the greatest impact on tobacco consumption would be obtained by increasing the taxes on tobacco products from 30% up to 80% of the retail price of tobacco products.

Focus group

The aim of the third stage of the study was data validation and the preparation of a data package suitable for analysis.

To achieve this goal, a focus group was organized and took part in a two-day event (in June). The focus group was presented with the initial data from the WHO-CHOICE tools and also input parameters calculated by the database of the National Bureau of Statistics, the National Center for Health Management, the National Centre for Public Health, the National Health Insurance Company, as well as national and international studies on epidemiology, use of resources and means.

Conclusions on contextualization

To ensure better cohesion with the local conditions, changes were made to the initial data on cost-effectiveness that served as a basis for contextualization in the WHO-CHOICE tool. For example, changes were made for demographic and epidemiological data and according to administrative and other costs required to run the programme.

The biggest difference between the data obtained by the WHO-CHOICE regional analysis and the initial data set for the Republic of Moldova was the decrease in the resources cost. This modification occurred mainly because the interpolations based on regional data have been calculated in accordance with the worldwide average number of the country population (50 million of inhabitants), which overestimates the quantum of resources necessary for administrative interventions in the countries with smaller populations, such as the Republic of Moldova.

Results of the analysis

The efficacy and cost-effectiveness of tobacco control measures implemented in the Republic of Moldova in 2010 were evaluated in comparison with tobacco control strategies set by the WHO-CHOICE tool. The following interventions, involving a broad coverage of the population, were analysed: an increase in taxes on tobacco products; a total ban on tobacco products advertising; a total ban on smoking indoors; labelling/information; nicotine replacement therapy; brief advice; and counselling people who want to quit smoking. In terms of the level of taxes applied on tobacco products, the year 2010 was considered to be the current situation.

The effectiveness of interventions is expressed by the averted health loss, i.e. healthy years of life gained. Loss of life-years is calculated as a result of premature death and disease condition due to tobacco consumption manifested by the quality of life worsening. Costs, health effects and rates of cost-effectiveness of all interventions regarding tobacco control are shown in Table 5.

Table 5. Costs, effectiveness and cost-effectiveness of tobacco control interventions in the Republic of Moldova

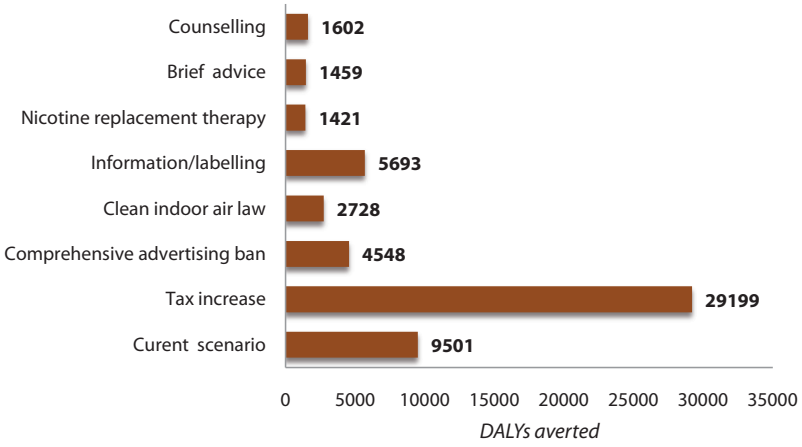
Nr.	*Intervention denomination*	*Annual cost (mil. MDL)*	*Annually averted DALY*	*Average cost-effectiveness (MDL per DALY averted)*	*Incremental cost-effectiveness* (MDL per DALY averted)*
1.	Current situation (2010)	252.1	9501	2654	Dominated
2.	Tax increase	252.1	29199	863	863
3.	Advertising ban	184.1	4548	4048	Dominated
4.	Clean indoor air law	89.3	2728	3274	Dominated
5.	Information/labelling	228.9	5693	4021	Dominated
6.	Nicotine replacement therapy	233.4	1421	16370	Dominated
7.	Tax increase and advertising ban	414.4	32903	1260	Dominated
8.	Tax increase and clean indoor law	324,3	31128	1042	Dominated
9.	Tax increase and nicotine replacement therapy	461.2	29854	1542	Dominated
10.	Tax increase, advertising ban and clean indoor law	499.2	35562	1404	Dominated
11.	Tax increase, advertising ban &information/labelling	631.8	38454	1643	Dominated
12.	Tax increase, advertising ban, clean indoor law and information/labelling	697.8	40059	1742	Dominated
13.	Combination of all interventions	709.8	40487	1753	4668

** rate of additional cost for a supplementary healthy life-year gained in addition to the next intervention.*

Analysis of the results of WHO-CHOICE methodology application indicates that the most effective intervention to reduce individual tobacco consumption is the increase of taxes on tobacco products by 50% (from 30% to 80% of retail price), which will allow an annual saving of 29 199 age-weighted healthy life-years, followed by interventions regarding information/labelling and a total ban on advertising, which will allow gaining of 5693 and 4548 healthy life-years

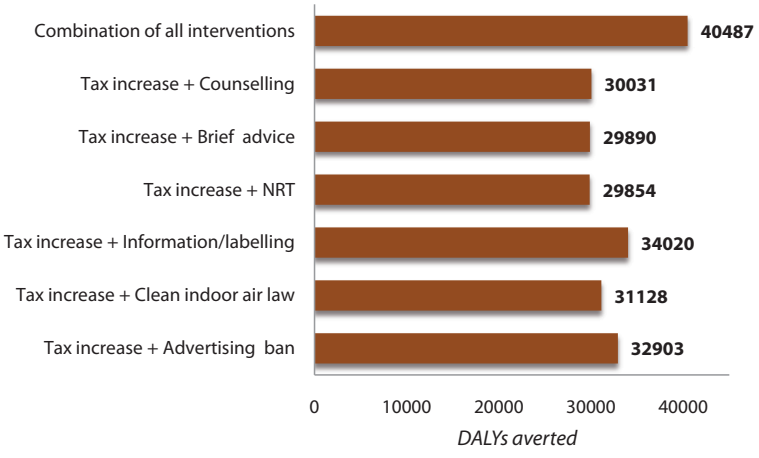
respectively. The least-effective interventions to reduce tobacco consumption are nicotine replacement therapy (NRT) and short messages, with 1421 and 1459 age-weighted healthy life-years gained annually (Figure 7).

Figure 7. Effectiveness of interventions in healthy years of life gained (DALYs averted) annually (separate interventions)



The most effective intervention is the combination of all separate interventions, which will allow an annual saving of 40 487 age-weighted healthy life-years (Figure 8).

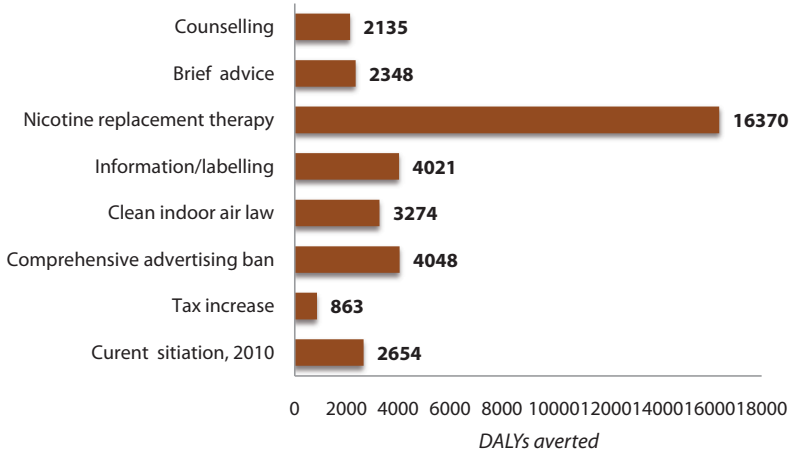
Figure 8. Effectiveness of interventions in healthy years of life gained (DALYs averted) annually (combined interventions).



It should be noted that a total ban on advertising is especially targeted at the consumption habits of young people and its expected long-term impact. Current studies do not state the full extension of this intervention and it may be underestimated in this analysis.

The results of the analysis indicate that most cost-effective intervention is the increase of the excise duties by 50% (from 30% to 80% of retail price), quantified in the amount of 863 lei per healthy life-year gained, followed by counselling (2135 lei per healthy life-year gained), brief advice (2348 lei per healthy life-year gained), clean indoor air law (3274 lei per healthy life-year gained) and information/labelling (4021 lei per healthy life-year gained). The least cost-effective intervention is nicotine replacement therapy, quantified by the value of 16 370 lei per healthy life-year gained (Figure 9).

Figure 9 Cost-effectiveness of interventions, shown in average cost (lei) per healthy life-year gained (DALY averted) for each individual intervention

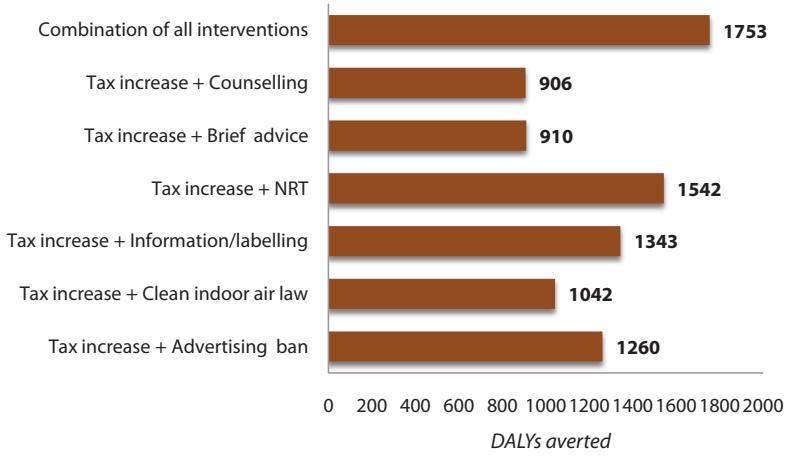


Each individual intervention under analysis, in line with the recommendations from the WHO Commission on Macroeconomics and Health, is highly cost effective because the cost of a healthy life-year gained is less than the gross domestic product per capita, which in 2010 was 20 171 lei.

The most cost-effective combination of interventions is the simultaneous implementation of tax increasing on tobacco products and counselling of

smokers. The second most cost-effective combination of interventions is tax increasing and sending brief advice from health professionals to smokers. This is followed by increasing tax supplemented by the clear indoor air law. The next one is tax increasing and advertising ban of tobacco (Figure 10).

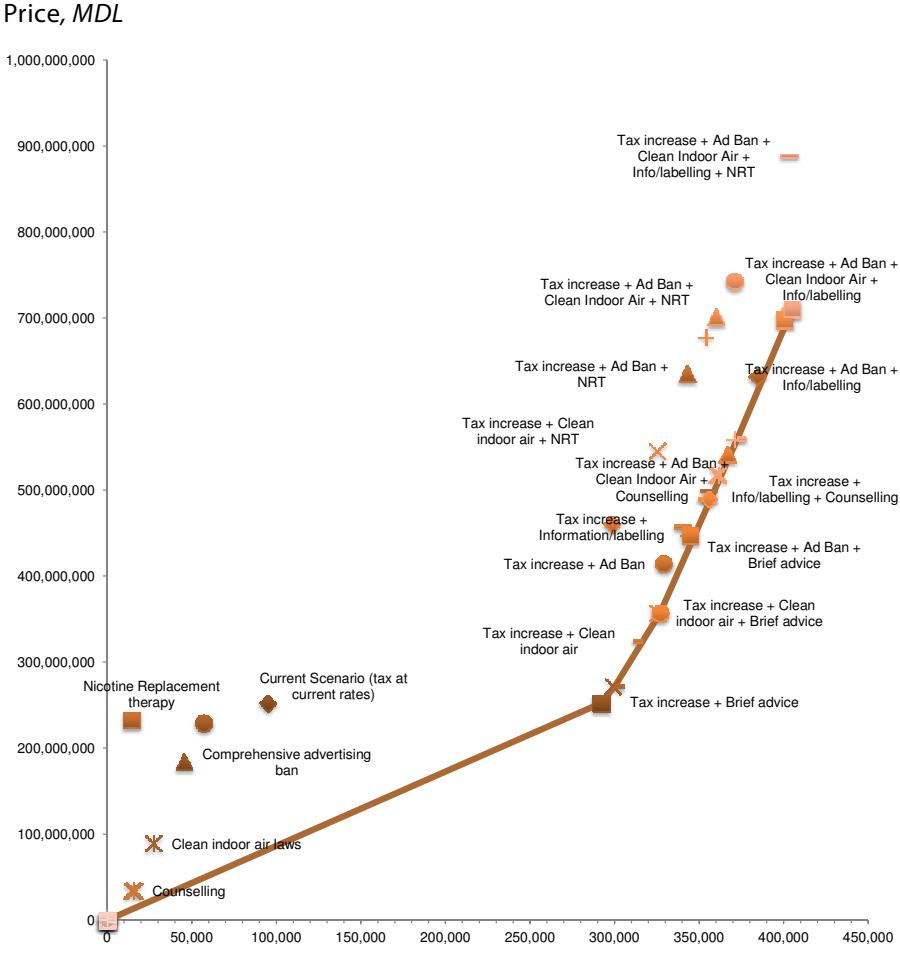
Figure 10 Cost-effectiveness of interventions shown in average cost (MDL) per healthy life-year gained (DALY averted) according to combined interventions.



According to the modelling data obtained by applying WHO-CHOICE, the cumulative application of tobacco control interventions in the Republic of Moldova over a period of 10 years (Figure 11) should be implemented in the following order:

1. increasing taxes on tobacco products (as a % of retail price) from 30% to 80%
2. combination of tax increase and counselling
3. combination of tax increase and brief advice
4. combination of tax increase and clean indoor air law
5. combination of tax increase and advertising ban
6. combination of tax increase and labelling/information
7. tax increase and nicotine replacement therapy
8. combination of all interventions.

Figure 11 Cost-effectiveness of cumulative interventions shown in additional cost (lei) per healthy life-year gained (DALY averted) implemented within a period of 10 years.



Analysis of the results of modelling of various scenarios regarding tobacco control interventions in the Republic of Moldova shows the benefits gained by society, which are manifested in the improvement of population health and a reduction in the burden of diseases caused by tobacco. All the interventions analysed within the framework of modelling are quantified as being below the gross domestic product per capita and are therefore rated as highly cost effective.

Conclusions and recommendations

The results of the analysis, applying WHO-CHOICE methodology, indicate that there are several cost-effective interventions available in the Republic of Moldova to reduce the disease burden caused by tobacco. The WHO Commission on Macroeconomics and Health suggests that all interventions that cost less than the gross domestic product per capita can be considered very cost effective in terms of the resources used. In 2010, in the Republic of Moldova, this figure was 20 171 lei. Therefore, for the quantum of all interventions to reduce tobacco consumption and exposure to tobacco smoke to be considered highly cost effective, the cost of a healthy life-year gained should be less than 20 171 lei.

In terms of cost-effectiveness, all the interventions in this analysis are acceptable for implementation. However, it is worth mentioning that the results of a cost-effectiveness analysis are only one of the resources used by policy makers in making decisions regarding population health improvement. It is important to mobilize political and public interests that legitimize the objectives of the health system (reduction of inequality in health care) and adjust the economic policies in general.

It is important to mention for decision makers that the proposed combined interventions do not appear within an extended framework, indicating the way forward for improvement in terms of cost-effectiveness. It should also be noted that much more DALYs can be averted by increasing the level of tax, expanding intervention coverage and improving law enforcement by reallocating current budgetary resources.

The results of this study indicate that investing in the solution to the problem caused by tobacco consumption and exposure to tobacco smoke is also beneficial in an economic context. This was also confirmed by the fact that all tobacco control interventions in this analysis are highly cost effective.

One of the major conclusions drawn from the analysis of effectiveness and cost-effectiveness of interventions on tobacco consumption control is the necessity of a gradual increase of the taxes on tobacco products.

It should be mentioned that the study presents tobacco consumption control interventions in terms of their effectiveness and cost-effectiveness and does not provide results of the indirect impact of their implementation, such as increased labour productivity and economic effects resulting from the population health improvement. This is due to the wide variety of effects obtained in comparison with the conditions they are caused by and means that these effects have been presented and quantified on a single scale.

Cost-effectiveness analysis of the interventions on tobacco control does not determine the monetary value of the quality of life-years. Monetary limits indicating that the intervention is cost-effective are set based on the results obtained. In terms of the given analysis, a limit has been applied in terms of the gross domestic product per capita, according to which the value of a healthy life-year can be estimated by the value of resources produced on average by a person per year.

The results of this study will be implemented through the approval and implementation of the National Tobacco Control Programme and also by reviewing, modifying and amending the existing legal framework with a view to conforming fully with the World Health Organization Framework Convention on Tobacco Control and current European legislation.

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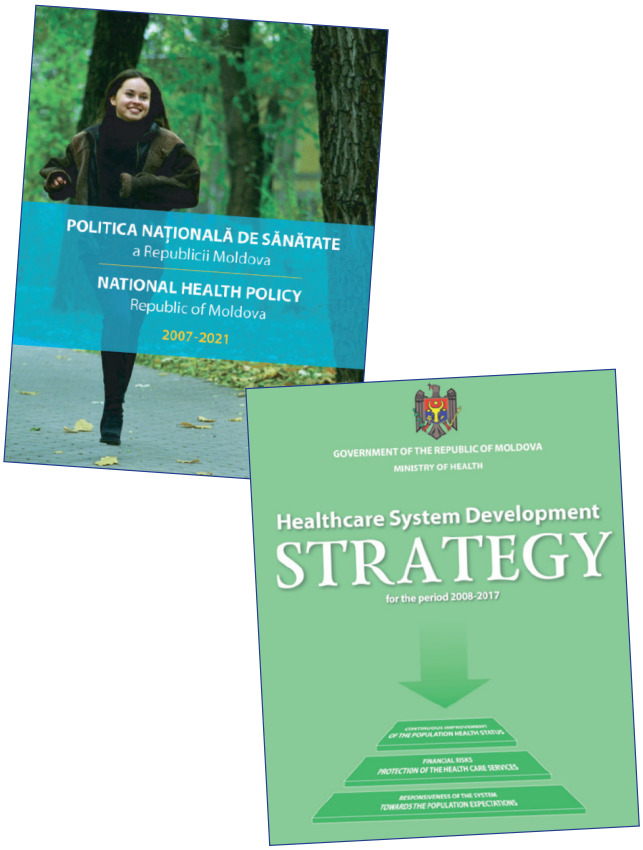

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