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# TOBACCO TAXATION INCIDENCE: EVIDENCE FROM RUSSIA

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# SUMMARY

## Background

The implementation of tobacco taxes is considered one of the most effective ways to discourage tobacco use. This policy has a direct impact on household incomes, especially among low-income households that are more likely to allocate a larger proportion of their budget to buying smokes. To assess the net welfare gains from this policy, one must look beyond the direct impact on household income and consider other benefits of lower tobacco consumption, including a reduction in medical costs and an increase in the potential working years associated with good health.

## Methods

Using an extended cost-benefit analysis to estimate the distributional effect of cigarettes in the Russian Federation, this paper finds that the long-run impact may in fact be progressive. The methodology applied incorporates the negative price effect caused by an increase in tobacco taxes, combined with a presumed future reduction in medical expenditures and a rise in working years caused by a reduction in the rate of smoking among the population. The analysis includes estimates of the distributional impacts of price rises on cigarettes under various scenarios based on information taken from the Russia Longitudinal Monitoring Survey–Higher School of Economics (RLMS-HSE) for 2010–16. One contribution is the quantification of impacts by allowing price elasticities to vary across consumption deciles.

## Findings

Overall, cigarette taxes exert a positive long-term effect on household incomes, though the magnitude depends on the structure of the conditional price elasticity. If the population is more responsive to tobacco price changes, then it would experience greater gains from the health and extended work-life benefits.

## Interpretation

The results support the use of tobacco taxation as an effective means to reduce tobacco consumption, raise government revenues, increase public health and promote income equality.



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# 1

# INTRODUCTION

The World Health Organization estimates that tobacco kills more than 7 million people worldwide each year (WHO 2017a). It is the second leading cause of death and disability worldwide and is among the major preventable causes of disease and premature death globally (Doll and Hill 1956; Ng et al. 2014; Wynder and Graham 1950). Diseases associated with tobacco use include lung cancer, stroke, ischemic heart disease, and respiratory diseases (DHHS 2004). Nearly 80 percent of the world's smokers live in low- and middle-income countries and are less likely to be informed about the adverse health effects of tobacco use relative to individuals in high-income countries. The Russian Federation is one of the largest producers and consumers of tobacco; 50 percent of the men and almost 14 percent of the women smoke (30 percent overall), above the average in the countries with high human development indexes.<sup>1,2</sup>

Tobacco taxes are often considered regressive because the share of household budgets allocated to tobacco products is larger among low-income households than among high-income households. This paper shows that, if behavioral and indirect effects, especially health-related effects, are taken into account, this is no longer valid. The long-run benefits of not smoking offset the costs associated with tobacco taxes among low-income groups and the overall population. Potential benefits include a reduction in medical expenditures and an increase in healthy life years, factors that translate into economic benefits that outweigh the losses created by tax increases if consumers quit or never start smoking.

This paper describes and quantifies the medium- and long-run effects of tobacco tax increases on aggregate household welfare through three channels. The first channel implies that higher tobacco prices because of higher taxes induce a behavioral response involving a reduction and cessation in tobacco consumption that is manifest particularly among people who discontinue smoking and younger individuals who do not start smoking. The second channel is associated with a reduction in medical expenses associated with the averted treatment costs of tobacco-related diseases, and the third is a rise in incomes because of gains in years of employment derived from an extension in life expectancy. To assess the impact of these effects, this paper estimates the price elasticity of tobacco, simulates upper- and lower-bound scenarios, and calculates the welfare gains among various income groups.

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<sup>1</sup> 2016 Global Adult Tobacco Survey (GATS), Russian Federation Factsheet: [http://www.who.int/tobacco/surveillance/survey/gats/rus\\_factsheet\\_2016.pdf?ua=1](http://www.who.int/tobacco/surveillance/survey/gats/rus_factsheet_2016.pdf?ua=1)

<sup>2</sup> The Human Development Index (HDI) is a summary measure of average achievement in key dimensions of human development: having a long and healthy life, being knowledgeable and having a decent standard of living. The HDI is the geometric mean of normalized indices for each of the three dimensions. The measure was introduced and measured by the United Nations Development Programme (UNDP).

The study is structured as follows. Section 2 reviews the literature on the health effects of tobacco, the economic costs associated with tobacco-related diseases, tobacco tax policies, and price elasticities. Section 3 presents an overview of the data used to estimate the impact of the tobacco tax. Section 4 examines the results. The final section concludes with a discussion on policy implications.





## 2

# LITERATURE REVIEW

Stefler et al. (2018) estimate that the population share associated with smoking among cancer deaths in Russia was 25 percent.<sup>3</sup> Close to 300,000 Russians died because of tobacco-related illnesses (GBD 2016). A 2002 study by the WHO suggests that tobacco-related diseases may shorten the healthy years of life by 13.6 years<sup>4</sup> (Mathers et al. 2002). This has negative consequences on human capital development and imposes a growing economic burden because smoking decreases earnings potential and labor productivity.

Several studies have quantified the economic cost of smoking, though most have been carried out in high-income western countries (Guindon et al. 2007). Goodchild, Nargis, and Tursan d'Espagnet (2018) find that tobacco-related diseases accounted for 5.7 percent of global health expenditure in 2012 and that the total economic costs of smoking, including health expenditure and productivity losses, were equivalent to 1.8 percent of the world's gross domestic product (GDP) (US\$1.85 trillion in purchasing power parity U.S. dollars). According to these authors, upper-middle-income countries, such as Russia, experience almost a third of this burden.<sup>5</sup> Estimates for the economic burden in the case of Russia vary between US\$8 billion and US\$17 billion (Potapchik and Popovich 2014; Goodchild, Nargis, and Tursan d'Espagnet 2018).

Tobacco price increases are also associated with expansion in productive life years. Verguet et al. (2015) analyze the health effects of price increases in China and conclude that a 50 percent rise in prices would result in 231 million life years gained over 50 years and would have a significant impact among the poor. In contrast, Pichón-Riviere et al. (2014) estimate that tobacco use in Chile would reduce life expectancy by nearly 4.0 years among women and 4.3 years among men. For Russia, Maslennikova et al. (2013) estimate that, if taxes were raised to 70 percent of the retail price, along with other policies, such as banning smoking in public places, 3.7 million tobacco-related deaths would be averted, although this may be a low prediction because secondhand smoking effects were not taken into account. According to the WHO, secondhand smoke is responsible for over 890,000 premature deaths a year worldwide (WHO 2017a).

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<sup>3</sup> Randomly selected participants living in mid-size towns in Belarus, Hungary, and Russia provided information on smoking habits, alcohol consumption, vital statistics, and cause of death (if applicable) of male relatives (fathers, siblings, and partners). The population attributable risk (PAR) fraction of cancer deaths (ages 35–79) because of smoking, alcohol consumption, or both was estimated between 2001 and 2013. Among 72,190 men, 4,702 died of cancer.

<sup>4</sup> This number might be overestimated due to alcohol abuse effect. Some twenty years ago the number of life years lost was estimated as 5-7 years (Gerasimenko, 2001).

<sup>5</sup> Goodchild, Nargis, and Tursan d'Espagnet (2018) estimate the economic cost of smoking-attributable diseases at US\$354 billion in upper-middle-income countries (purchasing power parity U.S. dollars).

Tobacco taxation has been recognized as one of the most effective tobacco control strategies. In high-income countries, a 10 percent increase in the price of cigarettes is associated with a decrease in the demand for cigarettes of approximately 4 percent (World Bank 1999). In low- and middle-income countries, an equivalent increase is associated with an average 6 percent reduction in cigarette consumption (Chaloupka et al. 2000). Higher taxes have the additional benefits of reducing exposure to secondhand smoke and increasing government revenues. Maslennikova et al. (2013) estimate that a 10 percent rise in price would reduce cigarette consumption among people under 35 by 3 percent and among people over 35 by 1 percent. This may be because price elasticities for tobacco products are higher among young people. Lance et al. (2004) use data from three waves of the Russia Longitudinal Monitoring Survey–Higher School of Economics (RLMS-HSE) (1996, 1998, and 2000) to estimate the demand for cigarettes among men and find that the price elasticity of smoking participation was between –0.106 and –0.050. However, young people (ages 13–19) were found to be much more price sensitive; the total elasticity was –0.345. Additionally, recent decreases in tobacco consumption have occurred in lockstep with increased prices of cigarettes from the pass-through of excise and ad valorem taxes.<sup>6</sup>

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<sup>6</sup> Sakharova, Antonov, and Salagay (2017) observe a 25 percent decrease in consumption in 2005–14 that correlates with government action on the tobacco epidemic.





## 3 / MODEL

In this paper, the impact of raising tobacco taxes in Russia is estimated using an extended cost-benefit analysis as in other studies (Pichón-Riviere et al. 2014; Verguet et al. 2015).

The paper analyzes three factors to estimate how tobacco taxes affect household incomes. First, assuming tobacco consumption does not change, tobacco taxes directly affect household income because the share of household budgets allocated to tobacco purchases increases as the tax increases. Second, household medical expenses decrease as a result of a reduction or widespread cessation in tobacco consumption. Third, households experience a positive income change because of additional years of labor recovered through the extension of life expectancy. The aggregate effect of a tax policy is estimated as follows:

$$\text{Income effect} = \text{change in tobacco expenditure (A)} + \text{lower medical expenses (B)} + \text{rise in income (C)} \quad (1)$$

For further details on the methodology used, see annex A; refer also to Fuchs and Meneses (2017a).



# 4

# DATA AND DESCRIPTIVE STATISTICS

## Data

For the current analysis, we mainly used the data provided by the RLMS-HSE. This is a rich set of data on individuals and households, covering incomes, expenditures, and health status as well as attitudes toward smoking. The RLMS-HSE is an annual survey that allows researchers to construct panels to follow the same individuals over a few years at a time. The latest available wave of the survey when the analysis was conducted was the 2016 round.

The information on attitudes toward smoking is available on households and individuals. In the family questionnaire are questions about how much households spend on cigarettes and how many packs were purchased during a recent period. This allows the unit values (individual prices) of cigarettes to be calculated for all the households that were involved in smoking. There are also questions on how much the respondent smokes and how much the respondent spends on cigarettes.

Another source of information is cigarette prices in communities. This information is also collected through the survey. Prices for four types of cigarettes are collected in this section of the questionnaire: brands that are domestic, imported, cheaper, or more expensive. However, the variation in prices among households is relatively low. This is why the information is not helpful in the analysis.<sup>7</sup>

The analysis was run and is presented below by deciles that were defined using per capita expenditures (unless specified otherwise).

## Smoking prevalence in Russia

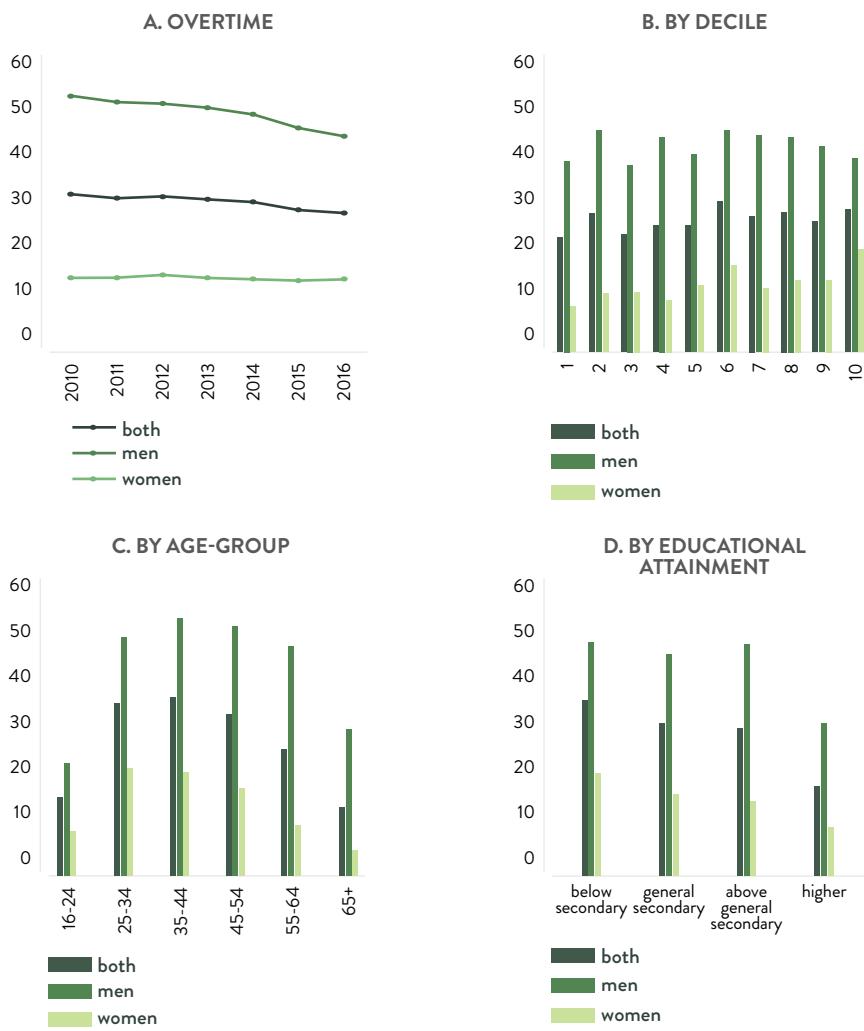
Despite the gradual decrease in recent years, smoking is still common in Russia (figure 1, panel a). According to RLMS-HSE data, 29 percent of the population ages 16–75 were smoking in 2016. Smoking is three times more popular among men (45 percent) than among women (15 percent). Smoking prevalence among men has been falling over the last decade and has declined by 10 percentage points since 2010, while, among women, prevalence has remained stable.

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<sup>7</sup> As a robustness check, we tried a few modules in which the prices in communities were used as instruments. However, the results appeared to be statistically unstable.

Smoking is common across the entire expenditure distribution (figure 1, panel b). While there is no specific pattern in smoking among men across deciles, smoking among women is clearly more popular among the more well off population. Smoking in Russia involves mostly filter cigarettes; the share among all cigarettes smoked is between 90 percent among the lower deciles to 100 percent among the richer deciles. Men smoke an average of five or six packs a week, while women smoke an average of four packs a week; these numbers are rather stable across the distribution.

**Figure 1 – Smoking Prevalence, Russian Federation (ages 16–75)**



Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2010–16.

Note: Deciles have been established using per capita household expenditures.

## Tobacco price elasticity by decile

Although several models have been tested to estimate elasticities by decile, the pooled cross-sectional model with year fixed effects and demographic controls at the household level is preferred (table 1; see annex B for more on the methodology and the various iterations of the estimation of tobacco price elasticities by decile).<sup>8</sup>

The estimated average cigarette price elasticity in Russia is  $-0.52$ , which is within the estimated elasticities found in the literature ( $-0.4$  and  $-0.8$ ), as well as those previously estimated for Russia.<sup>9</sup>

Table 1 – Cigarette Price Elasticities, by Decile

PRICE ELASTICITY	1	2	3	4	5	6	7	8	9	10
Lower bound	-0.48	-0.41	-0.38	-0.34	-0.32	-0.31	-0.29	-0.26	-0.25	-0.21
Medium	-0.68	-0.61	-0.58	-0.54	-0.52	-0.51	-0.49	-0.46	-0.45	-0.41
Upper bound	-0.88	-0.81	-0.78	-0.74	-0.72	-0.71	-0.69	-0.66	-0.65	-0.61

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2010–16.

Note: Deciles were created using per capita household expenditure. Lower- and upper-bound elasticities show average differences of  $-0.2$  and  $+0.2$ , respectively, with the medium-bound elasticity. Demographic controls include area, macroregion, and year fixed effects.

## Mortality and morbidity

Data on mortality, years of life lost, and morbidity have been obtained from the Global Burden of Disease Study. Ischemic heart disease, stomach cancer, and stroke are among the most prevalent diseases among men and women in Russia. In 2016, approximately 243,252 deaths were attributed to tobacco-related diseases, of which nearly 86 percent were men (208,451) (table 2). Similarly, more than 2.5 million cases of tobacco-related disease were reported in Russia the same year (table 3). A total of 5,979,509 years of life lost were estimated for all tobacco-related deaths in 2016 (table 4).

<sup>8</sup>To make this paper comparable to the other cases analyzed by the authors in the past (Chile, Ukraine, Moldova, South Africa, Indonesia, Bangladesh and Bosnia Herzegovina) it was decided to use household level data to estimate price elasticities. However, a full replication of the analysis using individual level data is also performed and included in the annex. Although there is a difference in levels, both analyses yield similar and consistent results in terms of trends and incidence.

<sup>9</sup>Only partial elasticity of consumption is estimated and used here unless specified otherwise. Using the full elasticity, including the effect on participation, would make the results more precise, but, because of computational difficulties, this step was omitted on the assumption that participation in smoking is less sensitive to relatively small changes in prices.

**Table 2 – Tobacco Related Deaths, by Gender and Age-Group, Russia Federation, 2016**

	WOMEN					MEN				
	25-34	35-54	55-74	75+	TOTAL	25-34	35-54	55-74	75+	TOTAL
Total Tobacco-related deaths	397	6,549	19,779	8,076	34,801	1,814	36,357	126,200	44,080	208,451
Bladder cancer	0	8	43	32	83	1	195	1,588	792	2,576
Cervical cancer	3	115	111	23	252	-	-	-	-	-
Chronic obstructive pulmonary disease	2	180	1,239	1,338	2,760	18	1,168	9,072	6,987	17,245
Colon and rectum cancer	1	55	234	103	392	2	259	1,433	444	2,138
Esophageal cancer	0	31	143	82	256	2	696	3,091	592	4,381
Ischemic heart disease	192	3,164	9,777	3,533	16,665	1,081	18,878	52,413	17,682	90,055
Larynx cancer	0	36	112	45	194	2	645	2,747	534	3,927
Leukemia	0	7	17	5	29	5	230	737	177	1,149
Lip and oral cavity cancer	1	52	138	54	245	4	781	2,252	360	3,397
Liver cancer due to other causes	0	2	7	3	12	1	83	339	88	510
Nasopharynx cancer	0	10	18	4	32	1	91	227	28	347
Stomach cancer	1	66	215	92	374	5	855	3,690	900	5,450
Tracheal, bronchus, and lung cancer	3	460	1,970	801	3,234	21	4,783	26,023	6,958	37,785
Tuberculosis	37	141	43	3	223	231	1,301	775	44	2,350
Stroke	156	2,224	5,712	1,958	10,049	441	6,391	21,814	8,495	37,141

Source: EGBD Results Tool (database), Global Burden of Disease Study 2016, Global Health Data Exchange, Institute for Health Metrics and Evaluation, Seattle, <http://ghdx.healthdata.org/gbd-results-tool>.

**Table 3 – Tobacco-Related Events, by Gender, 2016**

	ALL	WOMEN	MEN
Bladder cancer	17,898	4,051	13,847
Cervical cancer	15,718	15,718	0
Chronic obstructive pulmonary disease	334,223	83,351	250,873
Colon and rectum cancer	73,256	39,421	33,835
Esophageal cancer	7,943	1,510	6,433
Ischemic heart disease	1,200,833	651,505	549,328
Larynx cancer	9,221	748	8,473
Leukemia	10,843	5,276	5,567
Lip and oral cavity cancer	11,517	3,944	7,573
Liver cancer due to other causes	1,845	475	1,370
Nasopharynx cancer	845	171	674
Stomach cancer	40,978	18,991	21,987
Tracheal, bronchus, and lung cancer	53,673	10,624	43,049
Tuberculosis	82,910	24,279	58,631
Stroke	673,818	404,503	269,315
<b>Total</b>	<b>2,535,522</b>	<b>1,264,569</b>	<b>1,270,953</b>

Sources: GBD Results Tool (database), Global Burden of Disease Study 2016, Global Health Data Exchange, Institute for Health Metrics and Evaluation, Seattle, <http://ghdx.healthdata.org/gbd-results-tool>.

Note: Based on disease incidence. Incidence is defined as the number of new cases of a given disease during a given period in a specified population. It is also used for the rate at which new events occur in a defined population. It is differentiated from prevalence, which refers to all cases, new or old, in the population at a given time.

### Tobacco-related medical costs

The total tobacco-related medical expenses in the case of Russia used in this analysis have been calculated using national administrative data. The direct health care costs related to the treatment of tobacco-related diseases include the costs of medical care provided in outpatient facilities, hospitals, and day-care hospitals. It is calculated by disease using the information on the number of cases and the weighted average costs of the treatment for each case. The diseases considered are as follows:

- Diabetes
- Cardiovascular disease

**Table 4 – Years of Life Lost, by Gender, 2016**

	ALL	WOMEN	MEN
30-34	120,406	21,587	98,819
35-39	185,642	36,704	148,938
40-44	300,647	52,518	248,129
45-49	415,610	65,885	349,726
50-54	773,506	104,615	668,891
55-59	1,109,687	141,986	967,701
60-64	1,221,584	169,004	1,052,579
65-69	917,030	125,746	791,284
70-74	347,145	47,219	299,926
75-79	416,913	51,640	365,273
80 plus	171,339	29,945	141,395
<b>Total</b>	<b>5,979,509</b>	<b>846,848</b>	<b>5,132,661</b>

Source: GBD Results Tool (database), Global Burden of Disease Study 2016, Global Health Data Exchange, Institute for Health Metrics and Evaluation, Seattle, <http://ghdx.healthdata.org/gbd-results-tool>.

- Respiratory disease
- Cancer
- Tuberculosis

The number of diseases associated with tobacco smoking is calculated through the use of the indicator generally accepted in the available literature on population attributable risk (PAR). The PAR is calculated based on data on smoking prevalence and on the indicator of the relative risk (RR) of disease in smokers vs. nonsmokers. For the purposes of this paper, the RR has been taken from previous studies. The details of the calculations and the sources of information are summarized in annex C. The total direct tobacco-related medical costs in Russia in 2017 is estimated at the level of 418 billion rubles.<sup>10</sup>

<sup>10</sup> Alternatively, as a robustness check, the simulations have been performed using data from a cross-country comparable database. The most complete and standard study estimating the economic cost of smoking in Russia is Goodchild, Nargis, and Tursan d'Espaignet (2018). The study uses a cost of illness approach to estimate the economic cost of smoking attributable-disease in 152 countries. Annual direct health care costs attributable to tobacco use in Russia in 2012 amounted to 526 billion rubles.

## Baseline descriptive results

Table 5 summarizes the most important indicators, including total monthly household expenditures and the share of expenditures on smoked tobacco products in 2016. As of 2016, there was at least one smoker in each of 40 percent of all households. The share was highest among households in deciles 6–7 (an average 46 percent) and lowest in low-income households (32 percent). On average, households spent 0.9 percent of their total income on cigarettes, and lower-income households spent the highest share. For instance, the poorest decile spent 1.3 percent relative to 0.5 percent among the richest.

.....  
**Table 5 – Baseline Descriptive Results, 2016, by Decile**

INDICATOR	1	2	3	4	5	6	7	8	9	10
Expenditure per capita (Rub., monthly)	1,760	2,932	3,754	4,594	5,451	6,553	7,857	9,653	13,109	29,712
Expenditure per hh (Rub., monthly)	6,942	11,821	14,327	16,450	18,697	21,647	28,081	30,709	38,848	81,548
Prop. of exp. on tobacco products, %	1.3	1.1	0.9	0.9	0.9	1.1	0.8	0.8	0.7	0.5
HH that smoke tobacco, %	32	40	37	39	39	47	45	44	41	40
HH Size	3.9	4.0	3.8	3.6	3.4	3.3	3.6	3.2	3.0	2.8
Area (regional center), %	21	29	29	36	41	43	45	47	54	58
Female, %	52	50	55	54	55	54	54	53	55	56
Age 16-34, %	35	37	37	36	32	38	35	33	34	31
Age 35-54, %	35	31	32	31	32	33	33	36	34	36
Age 55+	30	32	31	34	35	29	32	31	32	34
Higher education, %	10	16	15	19	19	21	23	25	32	38
Years smoking (for smokers)	25	25	24	24	25	24	25	25	25	25

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016.

Note: Deciles have been established using per capita household expenditure



# 5 / RESULTS

To analyze the distributional effects of an increase in tobacco taxes, we estimate the effect on prices, medical expenditures, and working life years, aggregating these three into a single measure. The price elasticities estimated in table 1, including the lower-and upper-bound elasticities, allow us to understand how the results could change under different assumptions.

## Tobacco price increase

Income changes that arise from an increase in tobacco prices are estimated for each decile based on low , medium-, and upper-bound elasticities. Using the price elasticities and the share of household expenditure on tobacco by decile, we can simulate the effects of an increase in tobacco prices (see annex A, equation A.2). To show the effect of the elasticities on prices, table 6 also includes estimates of a complete pass-through scenario (i.e. assuming a price elasticity equal to zero), whereby the increase in prices is completely transferred to consumers without a reduction in consumption. For instance, if we assume that the prices for tobacco products rose by 25 percent, given the medium-bound elasticity for cigarettes for the bottom decile (-0.68) in table 1 and the proportion of cigarettes expenditures for the bottom decile (1.3 percent) in table 5, the expected increase in household expenditures would be 0.01 percent (table 6). This represents a loss in welfare because consumers would devote a higher share of their incomes to purchasing the same amount of tobacco, thereby reducing the consumption of other goods. These results hold for all the scenarios analyzed.

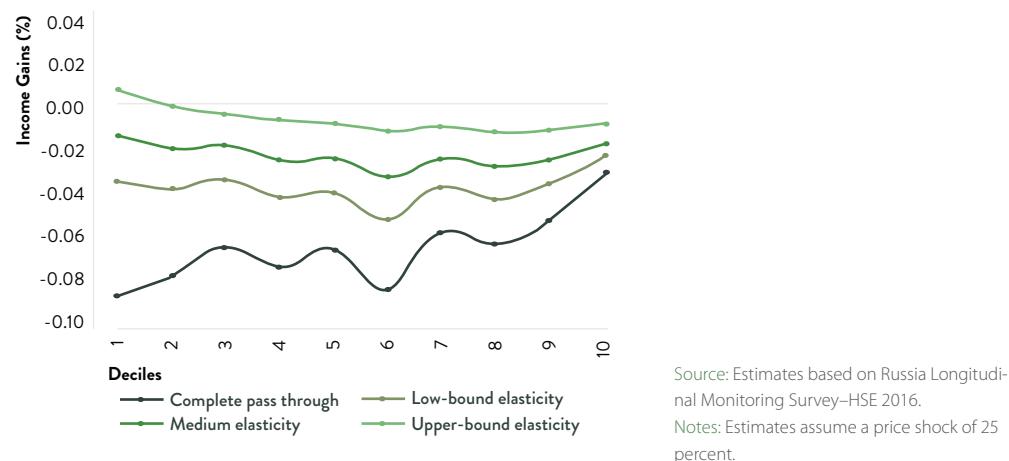
Table 6 - Direct Effect of Price Increase through Taxes (%), by Decile

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Complete pass-through	-0.09	-0.08	-0.06	-0.07	-0.07	-0.09	-0.06	-0.06	-0.05	-0.03
Low-bound elasticity	-0.03	-0.04	-0.03	-0.04	-0.04	-0.05	-0.04	-0.04	-0.04	-0.02
Medium elasticity	-0.01	-0.02	-0.02	-0.02	-0.02	-0.03	-0.02	-0.03	-0.02	-0.02
Upper-bound elasticity	0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016..

Note: The table shows the share of total consumption for each decile. Complete pass-through refers to elasticity equal to zero; consumers pay all the increased prices, and this does not affect the quantity purchased.

**Figure 2 – Income Gains: Direct Effect of Tobacco Taxes (Increase in Expenditure because of tobacco taxes), by Decile**



## Medical expenses

Tables 7 and figure 3 report the income effect of a reduction in medical expenses. As noted above, the model assumes that the health effects of tobacco-related diseases will immediately diminish with the reduction in tobacco consumption. Even though this assumption is implausible in the short-term because changes in the effects of tobacco-related diseases take some time to materialize, it provides an upper-bound estimate of the effects of tax increases. The overall results indicate that the reduction in medical expenditures is highly progressive, disproportionately benefiting lower-income groups. This derives from two factors: (1) the higher price elasticity and (2) a lower income base that massively benefits from the reduction in medical costs.

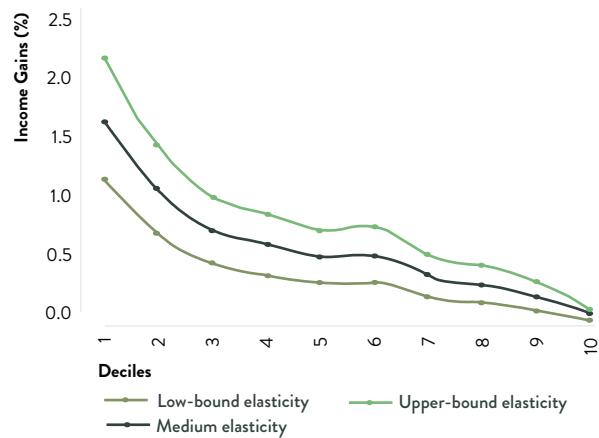
**Table 7 - Reduction in Medical Costs (%), by Decile**

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Low-bound elasticity	1.13	0.71	0.50	0.41	0.34	0.34	0.23	0.18	0.14	0.05
Medium elasticity	1.60	1.05	0.76	0.65	0.55	0.56	0.40	0.33	0.24	0.10
Upper-bound	2.07	1.39	1.02	0.89	0.76	0.78	0.56	0.47	0.35	0.15

Sources: Estimates based on the Russia Longitudinal Monitoring Survey 2016.

Notes: The table reports the share of total consumption for each decile.

**Figure 3 – Income Gains: Medical Costs of Tobacco Taxes (Reduction in Medical Expenditures), by Decile**



Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016.

Notes: Estimates assume a price shock of 25 percent.

### Income gains deriving from an increase in working life years

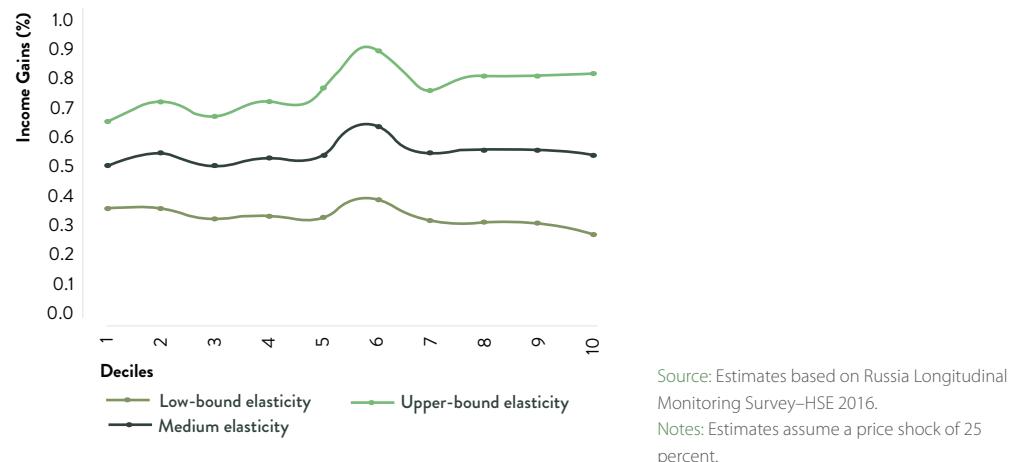
We estimate the cost of the working life lost because of tobacco consumption, assuming that the impact of lower tobacco use on health and work-generated income is direct. The 6.0 million years of life lost attributed to tobacco consumption are distributed using the occurrence of mortality profile. For each death, working years lost are divided across deciles proportionately to the number of households that consume tobacco in each income group. The results show that the reduction in tobacco consumption and the expected reduction in work years lost have a positive impact on welfare that represents a transversal income bump among all decile groups (table 8 and figure 4).

**Table 8 – Years of Working Life Lost (%), by Decile**

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Low-bound elasticity	0.35	0.36	0.32	0.32	0.31	0.38	0.32	0.31	0.31	0.27
Medium elasticity	0.49	0.53	0.49	0.51	0.51	0.63	0.54	0.55	0.55	0.53
Upper-bound elasticity	0.64	0.70	0.66	0.70	0.71	0.88	0.76	0.79	0.79	0.79

Source: Estimates based on the Russia Longitudinal Monitoring Survey–HSE 2016.

Note: The table reports the share of total consumption for each decile. Years of life lost have been estimated using all deaths from tobacco-related diseases.

**Figure 4 – Income Gains: Production during Years Lost, by Decile**

## Net effects: total distributional impact

In this subsection, we add the previous results to estimate the aggregate effect of an increase in tobacco taxes (see equation 1). The aggregate effect of an increase on tobacco taxes is positive and progressive; in the long run, poorer deciles benefit more than richer ones. The positive effect of reduced medical expenses and years of life gained offset the negative price effect.

Under any tobacco price elasticity scenario, the overall effect for cigarettes is always positive and progressive (table 9 and figure 5). Moreover, the benefits are amplified if we compare the lower-bound elasticity with the upper-bound elasticity. Apparently, a population in which medical expenses are high and which is sensitive to tobacco price changes will reduce consumption sufficiently to allow work and health benefits to offset cost increases. This is exactly what happens in Russia. Furthermore, the assumptions in this model do not include other possible policies, such as smoking cessation programs, antismoking advertising, youth outreach, or policies financed through the new tax revenue. Therefore, these results are in line with the literature, showing the important role that taxation plays in lowering tobacco usage.

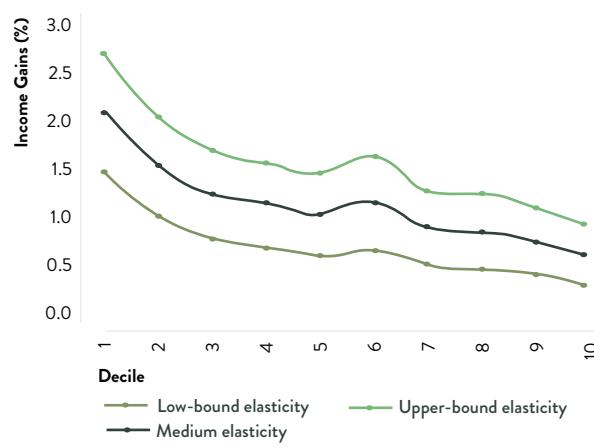
**Table 9 - Net Effect on Household Expenditures (%), by Decile**

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Low-bound elasticity	1.44	1.03	0.78	0.69	0.61	0.67	0.51	0.45	0.41	0.31
Medium elasticity	2.08	1.56	1.23	1.14	1.04	1.16	0.91	0.85	0.77	0.62
Upper-bound elasticity	2.71	2.09	1.68	1.59	1.47	1.66	1.31	1.25	1.13	0.93

Source: Estimates based on the Russia Longitudinal Monitoring Survey–HSE 2016.

Note: The table reports the share of total consumption for each decile.

**Figure 5 – Total Income Effect: Direct and Indirect Effects of Tobacco Taxes (Tobacco price increase, medical expenditure, and working years gained), by Decile**



Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016.

Notes: Estimates assume a price shock of 25 percent.



# 6

## DISCUSSION

Despite the wealth of research on the negative effects of tobacco consumption and on the benefits of various public policy mechanisms aimed at reducing tobacco use, questions remain about the progressivity or regressivity that these entail. The implementation of tobacco taxes is considered one of the most effective ways to discourage tobacco use. Nonetheless, this policy has a direct impact on household incomes, especially among low-income households that allocate a larger proportion of their budget to buying smokes. Moreover, the net effect of an increase in tobacco taxes depends on the price elasticity of this product across different segments of the population. The price elasticity determines the magnitude of the income shock and the benefits gained from a decline in tobacco consumption.

To assess the net welfare gains from this policy, one must look beyond the direct impact on household income and consider other benefits of lower tobacco consumption, including a reduction in medical costs and an increase in the potential working years associated with good health. Thus, it is critical to justify the maintenance or intensification of the use of tobacco taxes by means of a demonstration of the aggregate monetary gains or losses generated. Moreover, the policy should focus on low-income households that are typically more likely to smoke and, hence, tend to be the most affected by consumption taxes. One of the main motivations for this study is the ability to weigh the main costs and benefits of tobacco taxation to determine if, in the end, the policy is regressive.

The results show that, considered by itself, a tobacco price increase through higher taxes generates negative income variations across all groups in the Russian population because overall prices increase. These negative effects are particularly acute in the scenario of lower-bound elasticity, and they are more moderate as elasticity expands in absolute terms. Based on the assumptions behind a more comprehensive approach, including benefits through lower medical expenses and an increase in working years, the overall monetary effect reverses and is positive and progressive among all deciles.

The three price elasticity scenarios mimic the short- versus the long-term effects of tobacco taxes. There is evidence that adult smokers will only present small changes in their behavior if prices increase; the lower-bound elasticity would represent this behavior more closely. In contrast, younger groups of the population would show more elastic demand, similar to the upper-bound elasticity. After a few decades, we expect the impact of the tax policy to resemble the upper-bound elasticity scenario.

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# ANNEXES

## A. Model

This section describes the partial equilibrium approach used to simulate the impact on consumption of an increase in the price of cigarettes. This approach is used to evaluate the first-order effects of a change in prices. It relies mainly on household expenditure patterns. The focus is on the impacts of a rise in the price of cigarettes because this has been the focus of the potential reform of tobacco taxes.

To assess the distributional impact of an increase in the price of cigarettes, the simulation allows for differences in the responses across consumption deciles to reflect the fact that poor households likely have different price elasticities relative to households with more resources. The different elasticities, combined with the initial consumption patterns across deciles, explain whether a price reform will be more regressive, more neutral, or more progressive.

The loss of real consumption arising from the price increases in a product  $i$  is obtained as follows:

$$(\omega_{ij} + \Delta\omega_{ij}) * \frac{\Delta p_i}{p_{i,o}}, \quad (\text{A.1})$$

where  $\omega_{ij}$  is the share of product  $i$  in total household expenditure for a household in a decile  $j$ ;  $\Delta p_i$  is the price increase; and  $\Delta\omega_{ij}$  is the change in the consumption of the good that depends on the price elasticity of the product.<sup>11</sup>

### ***Change in tobacco expenditure***

To estimate the variation in cigarette consumption after the price increase, the model considers the change in prices ( $\Delta p_i$ ), the tobacco price elasticity ( $\varepsilon_j$ ) for decile  $j$ , and the share of cigarette expenditure in period 0 ( $\omega_{ij}$ ). The change in expenditure for each household in each decile is presented as a share of total expenditure and averaged by decile to quantify the overall impact, as follows:

$$\Delta \text{Expenditure}_{i,j} = ((1 + \Delta P)(1 + \varepsilon_j * \Delta P)^{-1}) * \frac{\omega_{ijo}}{\text{Total expenditure}_{j0}} \quad (\text{A.2})$$

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<sup>11</sup> For a detailed discussion of the methodology, see Coady et al. (2006); Kpodar (2006).

### **Medical expenses**

The change in medical expenses associated with tobacco-related diseases is estimated using equation (A.3), where the cost of treatment of tobacco-related diseases for income decile  $i$  is obtained from administrative data. The cost of tobacco-related medical expenses is distributed across income decile  $i$  according to the share of households that consume tobacco in decile  $i$ . Equation (A.3) shows the income gains associated with the reduction in medical expenses because of reduced tobacco consumption over the long term.

$$\Delta \text{ Medical expenditure}_{i,j} = ((1 + \varepsilon_j * \Delta P) - 1) * \frac{\text{Cost Treat.Tobacco Related Diseases}_i}{\text{Total expenditure}_j} \quad (\text{A.3})$$

A reduction in tobacco consumption in the long run would be strongly related to a reduction in tobacco-related diseases. The model assumes that the health effects of tobacco-related diseases will immediately diminish with the reduction in tobacco consumption. Even though this assumption is implausible in the short term because changes in the effects of tobacco-related diseases take some time to materialize, it provides an upper-bound estimate of the effects of tax increases.

### **Increase in working life years**

The model estimates the impact on income arising from the increase in working years (equation A.5). To estimate the increase in working years, the years of life lost (YLL) from tobacco-related diseases are distributed across deciles ( $i$ ) proportionally to the number of households that consume tobacco (equation A.4). Subsequently, the income lost is estimated as the average income per household in decile  $i$ . Overall, the model anticipates that income will increase as the number of years lost drops off because of the decline in premature deaths associated with the decline in tobacco consumption.

$$\text{Working Years}_i = (YLL_i * \text{Share of Smokers}_i) / \text{Population}_i \quad (\text{A.4})$$

$$\Delta \text{ Income}_i = ((1 + \varepsilon_j * \Delta P) - 1) * \frac{\text{Working Years}_i * \text{Total Expenditure}_i}{\text{Total expenditure}_i} \quad (\text{A.5})$$

The total income gains in each income group are estimated by adding the results of the increase in tobacco expenditures, the reduction in medical treatments, and the gain in working years (equation 1 in the main text).

## B. Tobacco Price Elasticity by Decile

Let  $Q_{id}$  be defined as the average quantity smoked per day by individual  $i$  in income decile  $d$ ;  $P$  the average price per cigarette (unit value of tobacco use);  $D_i$  the consumption decile of individual  $i$ ; and  $X_{id}$  the individual characteristics. Then, the smoking intensity equation is written as follows:

$$\ln Q_{id} = \beta_0 + \beta_1 \ln P * D_i + \beta_3 X_{id} + \mu_{id} \quad (\text{B.1})$$

The empirical analysis of equation (B.1) assumes a log-log relationship among smoking intensity, price, and income.  $\ln Q_{id}$  is observed if and only if the individual from a given decile  $d$  is a current smoker.

Several models were tested before deciding on the final elasticities used. All relied on the RLMS-HSE in 2010–16. Table B.1 considers the main equation using cross-sectional estimates and some that use the panel feature of the data. All the models were tested without controls and then adding demographic controls and year fixed effects. Among control variables included in the household level model were urban status, macroregion and year fixed effects. For the individual level cross-section and panel models, the controls included age, education, number of years smoked, urban status, macroregion, and year fixed effects.

**Table B.1 - Regression Results, by Model**

	1	2	3	4	5	6	7	8	9	10
<i>Both</i>										
Cross-section (ind level)	-0.25	-0.23	-0.22	-0.21	-0.20	-0.21	-0.20	-0.20	-0.19	-0.19
Panel (RE)	-0.14	-0.13	-0.13	-0.12	-0.12	-0.12	-0.12	-0.12	-0.11	-0.11
Panel (FE)	-0.07	-0.06	-0.06	-0.05	-0.05	-0.05	-0.05	-0.05	-0.04	-0.04
Panel (HT)	0.01	0.05	0.05	0.03	-0.03	-0.11	0.01	0.01	0.04	0.06
Cross-section (HH level)	-0.68	-0.61	-0.58	-0.54	-0.52	-0.51	-0.49	-0.46	-0.45	-0.41
Common prices	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.03	-0.02
<i>Men</i>										
Cross-section (ind level)	-0.22	-0.21	-0.20	-0.18	-0.17	-0.17	-0.17	-0.16	-0.16	-0.16
Panel (RE)	-0.13	-0.12	-0.12	-0.11	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10
Panel (FE)	-0.07	-0.06	-0.06	-0.05	-0.05	-0.05	-0.05	-0.04	-0.04	-0.04
<i>Women</i>										
Cross-section (ind level)	-0.33	-0.30	-0.27	-0.30	-0.31	-0.31	-0.31	-0.29	-0.29	-0.28
Panel (RE)	-0.17	-0.16	-0.14	-0.15	-0.15	-0.14	-0.14	-0.15	-0.14	-0.13
Panel (FE)	-0.07	-0.07	-0.04	-0.05	-0.05	-0.03	-0.04	-0.05	-0.03	-0.03

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2010–16.

Note: Demographic controls are included on every model. For the HH level cross-sectional demographic controls include: urban status, macro region and also controls for year fixed effects. For the individual level cross-section and panel models: gender, age, education, , number of years smoked, urban status, macroregion, and year fixed effects.

The total expenditures were deflated using the consumer price index, while the prices for cigarettes were deflated using the average prices provided by the Russian Federal State Statistics Service, Rosstat. To adjust for spatial variation in prices, all monetary variables were spatially deflated using the fixed basket index provided by Rosstat.

The deciles were defined based on per capita total expenditures. The panel model was estimated in both specifications, with fixed and random individual effects. According to the Hausman test, the hypothesis of no correlation between individual random effects and other regressors should be rejected, and the model with random effects provides biased estimates.

Self-reported prices are potentially endogenous because the decision on the brand of cigarettes to buy is taken together with the decision on the quantity of smoking. A few techniques were used to try to address this, as follows: (1) using communal prices as regressor and (2) using communal prices as an instrumental variable. However, because of lower variation in communal prices, these estimates led to uninterpretable results. This is why they were not used in the additional analysis.

## **C. Estimating direct health care costs associated with the provision of medical care related to tobacco-related diseases**

The direct health care costs related to treatment of tobacco-related diseases include costs of medical care provided in outpatient facilities, hospitals, and day-care hospitals for patients with the following diseases:

- Diabetes
- Cardio-vascular disease
- Respiratory disease
- Cancer, and
- TB

When calculating direct health care costs related to cases associated with smoking, the following were used:

- Tariffs calculated in accordance with the guidelines for paying per DGR-based completed treatment case, 2017 version.<sup>12</sup>
- Official data from statistical surveys forms:
  - № 7 "Information about malignant neoplasms", table 2000 "Information on newly diagnosed malignant neoplasms"
  - № 12 "Information on the number of diseases registered with patients living in the area served by a medical organization"<sup>13</sup>
  - № 14 "Information on performance of health facilities providing inpatient health care"
  - № 14 DC "Information on performance of health facilities providing inpatient health care in day-care hospitals"
- Standards of financial costs calculated for the Ministry of Health of the Russian Federation based on the Ministry of Finance methodology, for tuberculosis;
- Standards of financial costs for high-tech medical care according to the Order of the Government of the Russian Federation of 19.12.2016 N 1403 "About the Program of the state guarantees of free rendering medical care to citizens for 2017 and for planning period 2018 and 2019";

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<sup>12</sup> Letter No. 11-7 / 10 / 2-8080 of the Ministry of Health of the Russian Federation, FMHIF #13572 / 26-2 / and dated November 21, 2012, "On Guidelines for Medical Care Payments using MHI Proceeds" (Calculation Methodology).

<sup>13</sup> Ordinance of Rosstat of July 21, 2016 #355 "On the approval of statistical tools for the organization of federal statistical surveys in public health by the Ministry of Health of the Russian Federation".

- Number of cases of high-tech medical care in 2017;
- Values of the relative risk (RR) of smoking-related disease based on scientific publications, the results of scientific research available in open sources of information;
- Correction factor to the cost of outpatient visit according to the Letter of the Ministry of Health of the Russian Federation of 23.12.2016 № 11-7/10/2-8304 "On the formation and economic justification of the territorial program of state guarantees of free provision of medical care to citizens for 2017 and the planning period of 2018 and 2019;
- Ratio of outpatient visits in the completed outpatient case according to the Letter of the Ministry of Health of the Russian Federation of 23.12.2016 № 11-7/10/2-8304 "On the formation and economic justification of the territorial program of state guarantees of free provision of medical care to citizens for 2017 and the planning period of 2018 and 2019;
- Average standards of financial costs per unit of volume of medical care according to the Order of the Government of the Russian Federation of 19.12.2016 № 1403 "About the program of the state guarantees of free provision of medical care to citizens for 2017 and for the planning period 2018 and 2019."
- The average cost of drug provision at the outpatient stage, in rubles, calculated on the basis of the data of the analytical review of the Russian pharmacological market for 2017, prepared by DSM Group, for diseases of the circulatory system, respiratory system and malignant neoplasms. For diseases of diabetes mellitus, the average cost of drug provision is determined according to scientific research. For diseases of tuberculosis in an outpatient setting, drug therapy is included in the standard of financial costs.

In accordance with the Methodology, the size of the base rate for DRGs in the 24-hour and day hospitals was determined on the basis of the average standard of cost of hospitalization according to the Program of the state guarantees of free medical care to citizens for 2017 and for the planning period 2018 and 2019 (Rub 28,767.4), except for expenses on high-tech medical care, hemodialysis services (calculations were made according to the Federal compulsory health insurance Fund data received for performance of research work). Thus, the size of the base rate for the 24-hour hospital was 22,000 rubles and for the day hospitals, 10,000 rubles.

As a tariff for the cost of outpatient treatment, the average standard for the cost of outpatient visits in accordance with the Program of state guarantees for the provision of free medical care to citizens for 2017 and for the planning period of 2018 and 2019, equal to Rub 376.2 rubles, is taken.

Based on the results of the Global Adult Tobacco Survey (GATS)<sup>14</sup>, the prevalence of smoking in Russia in 2016 was 30.5%.

To calculate the number of diseases associated with tobacco smoking, the generally accepted indicator in available literature, indicator of population attributable risk (PAR), was used. PAR is calculated based on the data on smoking prevalence and on the indicator of the relative risk of disease in smokers vs. non-smokers (RR).

Calculation of the indicator of the relative risk of disease in smokers vs. non-smokers was not done, and values of the RR were taken from the open sources:

- Diabetes: during long-term follow-up: the Malmö Preventive Project. J Intern Med. 2006 Aug;260(2):134-41; <http://ex-diabetic.com/vashe-zdorove/caharnyj-diabet-i-kurenie.html>
- Cardio-vascular diseases: How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease: A Report of the Surgeon General. <https://www.ncbi.nlm.nih.gov/books/NBK53012/>
- Respiratory diseases: Краснова Ю.Н. Влияние табачного дыма на органы дыхания//Сибирский медицинский журнал, Том 137, №6, стр.11-16.2015 г.
- Cancer: Ying-Ying Wang, Wei Zhang, et.al. Population attributable risks of cigarette smoking for deaths of all causes, all cancers and other chronic diseases among adults aged 40-74 years in urban Shanghai, China. Chin J Cancer Res. 2015 Feb; 27(1): 59–65.; Белялова Н.С., Белялов Ф.И. Факторы риска и профилактика рака. Часть 1. Клиническая медицина 2005;11:17-21.
- TB: [http://www.who.int/tobacco/resources/publications/ru\\_tf\\_tb\\_tobacco\\_factsheet.pdf](http://www.who.int/tobacco/resources/publications/ru_tf_tb_tobacco_factsheet.pdf)

Population risk of smoking (RAR) was calculated by the formula:

$$RAR = ((p_0 + p_1 * RR) - 1) / (p_0 + p_1 * RR), \quad (C.1)$$

where

$p_0$  – proportion of non-smokers

$p_1$  – proportion of smokers

RR – the relative risk of diseases in smokers in relation to non-smokers.

<sup>14</sup> Global Adult Tobacco Survey: Overview, 2016. <https://static-1.rosminzdrav.ru/system/attachments/attaches/000/036/485/original/GATS-%D0%BA%D1%80%D0%B0%D1%82%D0%BA%D0%88%D0%BE7af5a0856d91%82%D1%87%D0%85%D1%82-%D1%80%D1%83%D1%81.pdf?1511269867>

The following algorithm was used to calculate the **cost of inpatient treatment in 24-hours and day care hospitals** for diseases caused by smoking:

1. define average base rate per inpatient treatment case in 24-hours and day care hospitals (averaging rates specified in regional tariff agreements);
2. extract information from statistical survey forms on the total number of cases of treatment for ICD-10 codes in question;
3. defining the values of RR based on available open sources
4. relate the disease classes with PAR indicators- the shares of diseases associated with smoking by disease (attributable risk of smoking);
5. determine the number of treatment cases triggered by smoking (the number of treatment cases under ICD-10 codes, multiplied by the relative attributable risk of smoking);
6. on diseases of the circulatory system, respiratory system, and malignant neoplasms: determination of the clinical profile group on the basis of decoding the DRGs provided in hospital and day hospitals, and the determination of the DRG weight on the profile of diseases;
7. for diabetes – determination of DRGs, which include the treatment of diabetes and the calculation of the average DRG weight for the disease;
8. calculate price per treatment case based on profile group (average base rate multiplied by average disease-profile weight);
9. determine the cost of treatment for diseases associated with tobacco smoking as the number of treated cases caused by tobacco smoking, multiplied by price per case under respective DRG profile group and multiplied by PAR.

Overall, the cost is determined by formula, as follows:

$$\text{Cost of inpatient care} = N_{\text{забол}}^{\text{МКБ}} * K_3^{\text{КПГ}} * BC * PAR, \quad (1)$$

where

*Cost* – the cost of inpatient treatment for diseases associated with smoking;

$N_{\text{забол}}^{\text{МКБ}}$  – number of registered diseases according to the ICD-10 code;

$K_3^{\text{КПГ}}$  – average weight of DRG profile groups;

$BC$  – average DRG base rate for inpatient care;

PAR – population attributable risk for ICD-10 code (the proportion of diseases associated with smoking).

For the calculation of health care losses from tuberculosis caused by tobacco, the calculation was made according to the following formula:

$$\text{Cost TB} = N_{\text{забол}}^{\text{МКБ}} * \text{NFZ} * \text{PAR}, \quad (2)$$

where

Cost TB – the costs for the treatment of diseases associated with tobacco;

$N_{\text{забол}}^{\text{МКБ}}$  – number of registered diseases according to the ICD-10 code;

NFZ – the standard of financial expenses of the treatment of patients with tuberculosis in the conditions of 24-hours and day-care hospitals;

PAR – population attributable risk for ICD-10 (proportion of tobacco-associated diseases).

The calculation of the costs of high-tech medical care related to tobacco-associated diseases was carried out in accordance with the following algorithm:

$$\text{Cost}_{\text{HTMC}} = N_{\text{HTMC}} * \text{PAR} * \text{NFZ}_{\text{HTMCav}},$$

where

$\text{Cost}_{\text{HTMC}}$  – the cost for high-tech medical care related to tobacco-associated diseases;

$N_{\text{HTMC}}$  – number of cases of high-tech medical care according to ICD-10 codes;

$\text{NFZ}_{\text{HTMCav}}$  – Average standard of financial expenses per high-tech medical care case;

PAR – population attributable risk for ICD-10 (proportion of tobacco-associated diseases).

The calculation of the cost of outpatient treatment of diseases caused by smoking was carried out in accordance with the following algorithm:

- extraction of the data from the form of statistical observation № 12 "Data on the number of diseases registered in patients living in the area of service of the medical organization" on the total number of cases of diseases for the considered ICD-10 codes;
- calculation of PAR – shares of diseases associated with smoking in the context of diseases (population attribute risk of smoking);
- determination of the number of cases of treatment related to smoking: the product of the number of cases of treatment according to the ICD-10 code and the PAR;

- determination of the correction factor to the cost of an outpatient visit taking into account the specialty, in accordance with the Letter of the Ministry of Health of Russia of 23.12.2016 N 11-7/10/2-8304 "On the formation and economic justification of the territorial program of state guarantees of free provision of medical care to citizens for 2017 and the planning period of 2018 and 2019";
- determination of costs for the outpatient treatment of diseases associated with tobacco as a product of the number of cases of diseases related with tobacco, fee per cases in the outpatient setting, including drug coverage, the values of the population attribute risk.

The calculation of the costs of drugs for treatment of outpatient cases was carried out according to the data on the volume of costs of the pharmaceutical market in the commercial segment (p. 15) and within the preferential drug provision (p. 41, 43), presented in the analytical review of the pharmacological market of Russia for 2017, prepared by the DSM Group, for each of the considered classes of diseases, except tuberculosis, and the number of cases of diseases.

In total, the costs/losses associated with outpatient treatment of tobacco-related diseases are determined by formula 3:

$$\text{Outpatient costs} = N \text{ cases} * (KP * T \text{ visit} + T \text{ drugs}) * PAR, \quad (3)$$

where

Outpatient costs – costs of outpatient treatment of tobacco-related diseases;

N cases – number of disease of the specified class of diseases;

KP – correction factor to the cost of a visit taking into account the specialty corresponding to the disease;

T visit – average norms of costs of outpatient treatment;

Kr – ratio of outpatient visits in the completed outpatient case;

T drugs – average cost of drug provision at the outpatient stage;

PAR – population attributable risk for ICD-10 (proportion of tobacco-associated diseases).

The total direct losses to the health care system for the treatment of tobacco-related diseases were calculated by summing up the losses in the inpatient and outpatient sectors.

## D. Robustness: Simulation Using Data on Individuals

**Table D.1 - Cigarettes Price Elasticities, by Decile**

PRICE ELASTICITY	1	2	3	4	5	6	7	8	9	10
Lower bound	-0.032	-0.014	0.005	0.015	0.020	0.017	0.018	0.026	0.029	0.036
Medium	-0.232	-0.214	-0.195	-0.185	-0.180	-0.183	-0.182	-0.174	-0.171	-0.164
Upper bound	-0.432	-0.414	-0.395	-0.385	-0.380	-0.383	-0.382	-0.374	-0.371	-0.364

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2010–16.

Note: Deciles were created using individual expenditure. Lower- and upper-bound elasticities show on average differences of -0.2 and +0.2, respectively, with the medium-bound elasticity. Demographic controls include: area, macro region and year fixed effects.

**Table D.2 - Direct Effect of Price Increase through Taxes (%), by Decile**

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Complete pass-through	-0.59	-0.46	-0.31	-0.31	-0.26	-0.29	-0.22	-0.20	-0.14	-0.08
Lower bound	-0.57	-0.45	-0.31	-0.31	-0.27	-0.29	-0.23	-0.21	-0.15	-0.09
Medium elasticity	-0.42	-0.34	-0.23	-0.24	-0.20	-0.22	-0.17	-0.16	-0.11	-0.07
Upper bound elasticity	-0.27	-0.22	-0.16	-0.16	-0.14	-0.15	-0.11	-0.11	-0.08	-0.05

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016.

Note: The table shows the share of total consumption for each decile. Complete pass-through refers to elasticity equal to zero; consumers pay all the increased prices, and this does not affect the quantity purchased.

**Table D.3 - Reduction in Medical Costs (%), by Decile**

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Lower bound elasticity	0.09	0.03	-0.01	-0.02	-0.02	-0.02	-0.01	-0.02	-0.01	-0.01
Medium elasticity	0.66	0.42	0.27	0.21	0.18	0.18	0.14	0.12	0.08	0.04
Upper bound elasticity	1.24	0.80	0.55	0.044	0.39	0.39	0.30	0.25	0.18	0.09

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016.

Note: The table reports the share of total consumption for each decile.

**Table D.4 – Years of Working Life Lost (%), by Decile**

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Lower bound elasticity	0.03	0.01	0.00	-0.01	-0.02	-0.02	-0.02	-0.03	-0.03	-0.04
Medium elasticity	0.20	0.21	0.17	0.17	0.17	0.21	0.19	0.20	0.18	0.20
Upper bound elasticity	0.38	0.41	0.35	0.35	0.36	0.43	0.41	0.42	0.40	0.45

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016.

Note: The table reports the share of total individual consumption for each decile. Years of life lost have been estimated using all deaths from tobacco-related diseases.

**Table D.5 - Net Effect on Household Expenditures (%), by Decile**

PRICE SHOCK SCENARIO	1	2	3	4	5	6	7	8	9	10
Lower bound elasticity	-0.45	-0.41	-0.32	-0.34	-0.31	-0.33	-0.26	-0.25	-0.19	-0.14
Medium elasticity	0.45	0.29	0.21	0.14	0.15	0.17	0.17	0.16	0.15	0.18
Upper bound elasticity	1.34	0.99	0.74	0.62	0.61	0.67	0.59	0.57	0.50	0.49

Source: Estimates based on Russia Longitudinal Monitoring Survey–HSE 2016.

Note: The table reports the share of total consumption for each decile.



