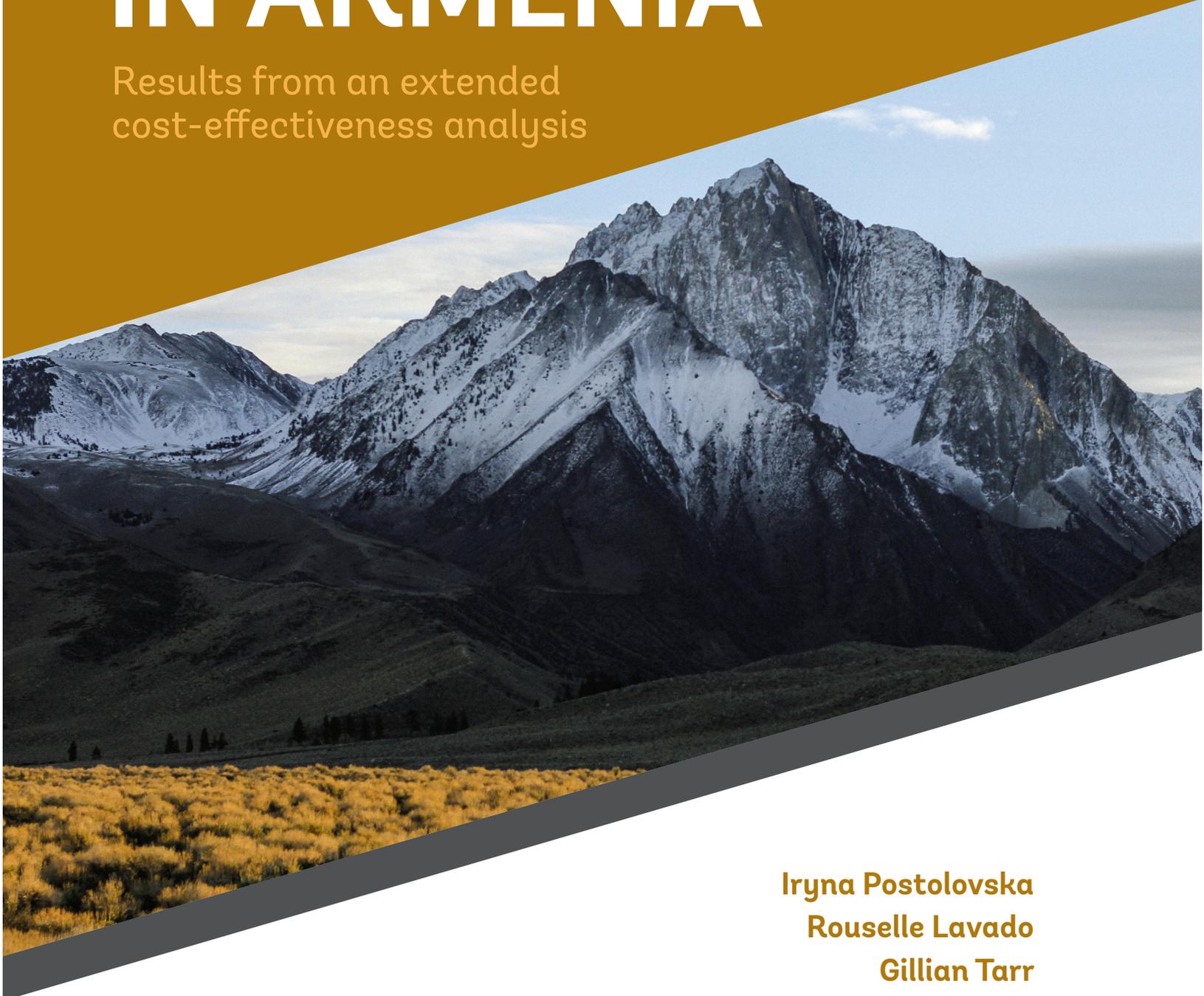


ESTIMATING THE DISTRIBUTIONAL
IMPACT OF INCREASING TAXES ON
TOBACCO PRODUCTS

IN ARMENIA

Results from an extended
cost-effectiveness analysis



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Abstract

Background

At present, tobacco taxes in Armenia are among the lowest in Europe and Central Asia. Global experience has shown that increasing taxes on tobacco is one of the most cost-effective public health interventions. This is particularly relevant for Armenia, where smoking is among the leading risk factors of mortality among the population.

Methods

We conducted an extended cost-effectiveness analysis (ECEA) to assess the health, financial, and distributional consequences of increases in the excise tax on cigarettes in Armenia. Specifically, we estimated (i) the number of premature tobacco-related deaths averted, (ii) out-of-pocket (OOP) expenditures related to treatment of tobacco-related disease averted, (iii) the number of averted poverty cases (number of individuals falling below the national poverty line as a result of incurred OOP medical expenditures for tobacco-related disease treatment), (iv) the number of averted catastrophic health expenditures (individuals spending more than 10 percent of their consumption expenditure on tobacco-related treatment), and (v) government savings resulting from averted treatment costs for those eligible for the government-funded basic benefits package. We simulated a hypothetical price hike leading to an excise tax rate of 75 percent of the retail price of cigarettes, as recommended by the World Health Organization, which would be fully passed onto the consumers (current Armenian male smoking population). In addition, we conducted a series of stakeholder interviews to gain a better understanding of how tobacco tax increases were placed on the political agenda in Armenia

Results

Increased excise taxes on tobacco would bring large health and financial benefits to Armenian households and be pro-poor: about 88,000 premature deaths, US\$ 63 million of OOP medical expenditures, 22,000 poverty cases, and 33,000 cases of catastrophic health expenditures would be averted. Government savings on tobacco-related treatment costs would amount to US\$ 26 million. Half of the premature deaths and 27 percent of poverty cases averted would be concentrated among the bottom 40 percent of the population.

The findings from the qualitative analysis suggest that the accession to the Eurasian Economic Union in 2015 and the fiscal constraints faced by the government created a window of opportunity for tobacco taxation to be placed on the policy agenda.

Conclusions

ECEA can be an important tool and input for policy decisions. In the case of Armenia, the ECEA findings point to the potentially largely pro-poor aspect of increased tobacco taxation.

Introduction

Tobacco use is a leading risk factor for premature mortality. Today, almost 7 million premature deaths per year are attributed to tobacco use globally, with almost 20 percent of those deaths occurring in Europe and Central Asia. (1) This can result in substantial societal costs, as half of those who die of tobacco-related non-communicable diseases (NCDs) are in the prime of their productive years.(2) Recent estimates indicate that the total economic cost of smoking, including health expenditures and productivity losses, amounted to US\$ 1436 billion in 2012 (approximately 1.8 percent of the world's annual GDP).(3)

Acknowledging the dire consequences of the tobacco epidemic, in 2003 the World Health Assembly adopted the World Health Organization's (WHO) Framework Convention on Tobacco Control (FCTC),(4) which has since been ratified by 180 countries. The FCTC recommends a multidimensional approach to reducing smoking, including demand-side interventions, such as tax measures on tobacco products.(4) In 2015, countries renewed their commitment for the fight against tobacco by pledging to strengthen the implementation of the FCTC under the Sustainable Development Goals (SDGs).(5)

Price measures have been at the forefront of the fight against tobacco.(6–10) Evidence has shown that price is the key determinant of smoking uptake and cessation, with numerous studies having found that price increases on cigarettes are highly effective in reducing demand by inducing smokers to quit and deterring non-smokers from initiating.(8) In addition, higher prices also result in current smokers reducing the number of cigarettes smoked daily and prevent ex-smokers from returning to smoking.(8,9) While tax hikes can generate additional revenue for development financing, as stated in the 2015 Addis Ababa Action Agenda and endorsed by the United Nations as part of the SDGs,(11) the main objective of tobacco taxes is to discourage product use and, as a result, avert the adverse health consequences of smoking.

The WHO recommends that countries increase the excise tax rate on tobacco products to 75 percent.(7,12) There are two types of excise taxes: specific and ad valorem. A specific excise tax is a fixed monetary value per quantity (e.g. per pack or kilogram of tobacco), while an ad valorem excise tax is levied as a

percentage of the value of tobacco products (e.g. per retail price).(8) Unlike other types of taxes, such as value-added tax (VAT), high specific excise taxes can narrow the price gap between the types of cigarette brands and encourage cessation rather than substitution to lower-priced cigarettes as a result of tax increases.(9,13) However, only 33 countries so far have raised tobacco excise tax rates to the WHO-recommended rate of 75 percent. (7) Opponents, particularly the tobacco industry, have used the potential “regressivity” of excise taxes as an argument against further tax increases to build coalitions in opposition to cigarette price increases.(14–16) According to the argument, since the poor spend a larger proportion of their disposable income on smoking than the rich, increases in cigarette taxes and prices could disproportionately hurt the poor.(17) Other commonly cited arguments against increasing tobacco taxes include lost government revenue, job losses, smuggling, and political unpopularity with the voters.(6,9)

With the SDGs, many international agencies such as the World Bank, are encouraging governments to adopt policies that would reduce poverty and boost shared prosperity by improving the living standards of the bottom 40 percent of the population.(18) Achieving these goals implies that policy recommendations pay special attention to the distributional impact of any reform to ensure that the poorer populations are benefiting the most.

Armenia represents a fitting country to examine the distributional impact of increased tobacco taxes. It is a lower middle-income country with almost 30 percent of its population living today below the national poverty line of around 41,700 AMD per month (approximately US\$100).(19) In recent years, Armenia’s economy has been hard hit due to regional and global economic conditions. With a public debt approaching almost 55 percent of its gross domestic product (GDP) and fiscal revenues representing only 22 percent of its GDP, Armenia is currently facing significant fiscal pressures. (20) Furthermore, smoking prevalence is high and tobacco use is one of the leading risk factors for premature mortality.(1) Almost 26 percent of Armenian adults smoke, largely the men (53 percent smoking prevalence among males as opposed to 2 percent among females).(21) Prevalence of smoking is particularly high among men in the second and third wealth quintiles of whom almost 60 percent smoke compared to 49 percent in the poorest quintile and 42 percent in the highest quintile.(22) In spite of an explicit publicly funded health benefits package, out-of-pocket (OOP)

healthcare expenditures represent almost 54 percent of the country's total health spending,(23) and 9 percent of households incur catastrophic health expenditures (spending more than 25 percent of their nonfood expenditures on health).(24)

Armenia was the first among the former Soviet Union countries to adopt and ratify the FCTC, which was shortly followed by the adoption, in March 2005, of a national law on "Restrictions on the sale, consumption, and use of tobacco" and a state program to control tobacco use.(25) Despite these initial moves, the government subsequently failed to act,(26) and Armenia now ranks behind many other countries in the region, such as Ukraine, Russia, and Georgia, on tobacco control efforts.(7) In particular, tax measures have remained inadequate to reduce demand for tobacco: tax as a share of the price of the most-sold cigarette brand constituted 34 percent in 2014 (17 percent excise tax and 17 percent VAT), with a mean price per cigarette pack of around US\$ 1.25.(27) In 2015, the Armenian government approved a package of draft laws to revise its tax code, including a proposal to increase tobacco taxes, in order to raise revenues.(28)

In this paper, we explored the potential distributional impact of increasing tobacco taxes in Armenia. We applied extended cost-effectiveness analysis (ECEA) methods (29–31) to assess the health, financial, and distributional consequences among smokers (males only, and by individual consumption quintile) of increases in cigarette taxes. We also conducted a series of qualitative interviews with key stakeholders to examine the agenda-setting discourse surrounding the recently proposed tobacco tax increases in Armenia.

Methods

Modeling approach

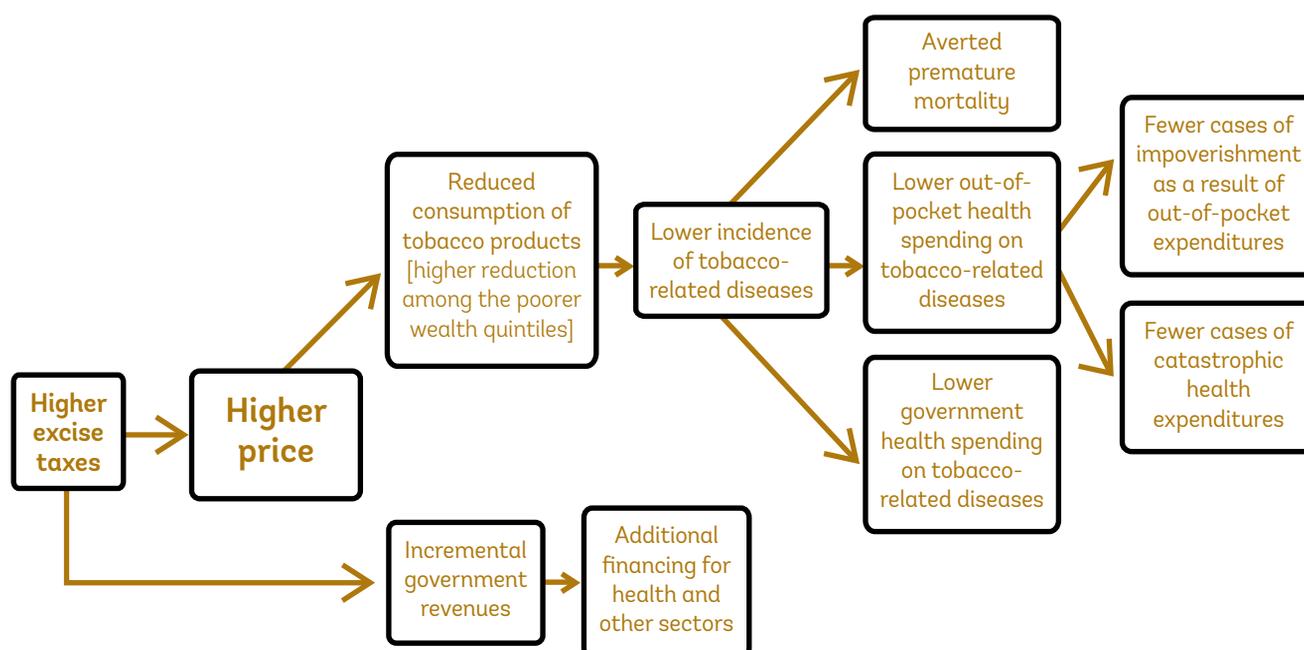
ECEA has been developed for health policy assessment (29,30) and applied to a wide array of policies including tobacco taxation.(31,32) ECEA intends to explicitly examine the outcomes of policy in multiple domains: the health benefits (e.g., premature deaths averted), the financial consequences for individuals and households (e.g., OOP expenditures averted due to disease treatment averted), the corresponding financial risk protection (e.g., cases of medical impoverishment or catastrophic health expenditures averted), and the distributional consequences among the population (e.g., per socioeconomic group, geographical setting). In doing so, it goes beyond traditional cost-effectiveness analysis in enabling quantification of the financial risk protection and equity (distributional) benefits of policy.(30)

Previous studies modeling the impact of tobacco tax increases have investigated their aggregate impact, but few have explored their distributional consequences. In addition, such studies focused their analysis primarily on health gains and often did not explore the smokers' financial consequences related to treatment of tobacco-related diseases. Here we built on a previously developed ECEA model for examining increases in tobacco taxes (31,41) to examine the premature deaths averted, the OOP expenditures averted and financial risk protection provided, and their distributions across socioeconomic groups among male smokers, by an increase in the excise taxes on tobacco products in Armenia.

Using the baseline excise tax rate of 17 percent and an average price per pack of 525 AMD (approximately US\$ 1.25),(27) we applied ECEA to simulate a price increase leading to the WHO-recommended excise tax rate of 75 percent.(7) We estimated that correspondingly the average price per cigarette pack would increase by 45 percent (to 756 AMD or US\$ 1.80). We assessed distributional impact in terms of: (i) averted premature tobacco-related deaths; (ii) averted OOP expenditures on tobacco-related disease treatment; (iii) government savings resulting from averted tobacco-related disease treatment costs for those eligible for the government-funded basic benefits package; (iv) averted cases of medical impoverishment (number of individuals falling below the national poverty line as a result of OOP

tobacco-related treatment costs); and (iv) averted cases of catastrophic health expenditures (number of individuals spending more than 10 percent of their individual consumption on tobacco-related treatment costs) (Figure 1).

Figure 1. Conceptual framework for modeling the health and financial impact of higher excise taxes on tobacco products among male smokers in Armenia.



In Armenia, smoking is largely concentrated among men: 53 percent of males smoke compared to 2 percent of females.(22) Hence, we restricted our analysis to the current male population only, which we divided into five-year age groups (age 0 to 84 and a single group for all men above 84) using population estimates from the World Bank’s Health, Nutrition, and Population Statistics database.(33) The population was subsequently divided into individual consumption quintiles, and the maximum consumption for each quintile was estimated using the 2014 Integrated Living Conditions Survey (ILCS).(24) We applied these consumption quintile cutoffs and the Gini index (estimated from the 2014 ILCS) to simulate an individual consumption distribution using a Gamma distribution.(34,35) Age- and quintile-specific smoking prevalence rates were used to calculate the total number of smokers per each age group and consumption quintile.

Due to data restrictions, we were not able to calculate the price elasticity of demand for tobacco products for Armenia. Rather, we assumed a price elasticity of demand for tobacco of -0.54, which was estimated from the 2015 Kyrgyz Integrated Household Survey (KIHS)(36) following the approach of Hu et al.(37) and Adioetomo et al.(38) This elasticity falls within the -0.40 to -0.80 estimated range of price elasticity of demand for tobacco in developing countries.(8,10) In line with findings from other studies,(8,9,32) the 2015 KIHS estimates also indicate that the poor are more responsive to price changes, with the elasticity ranging from -0.74 in the poorest quintile to -0.28 in the richest quintile (see supplementary webappendix). Although the Kyrgyz Republic exhibits a lower smoking prevalence among men (26 percent) and a lower average price of cigarette pack (0.60 US\$) compared to Armenia, excise tax rates are similarly low (16 percent specific and 8 percent ad valorem excise tax rates).(7) While we were able to estimate quintile-specific elasticities from the KIHS, we did not have the data necessary to estimate price elasticity by age-group. Based on evidence from reviews (8,39) we assumed that those under the age of 25 were twice as responsive to price changes as those above the age of 24.

We updated a simple static model (41) following a single cohort of all men alive in 2015. We assumed that the excise tax increase would be fully passed onto the consumers through a 45 percent increase in the retail price of tobacco and that half of price elasticity was due to participation elasticity. (8) We calculated the number of individuals by age group and individual consumption quintile who would quit (from the current adult male smoking population) or not initiate smoking (among those < 15 years) as a result of higher tobacco prices. For each age group a and consumption quintile q , the number of individuals who would quit or not initiate smoking ($\Delta S_{a,q}$) was calculated depending on the initial number of smokers ($S_{a,q}$), the participation elasticity (1/2), price elasticity $\epsilon_{a,q}$, and relative change in price ($\frac{\Delta p}{p}$):

$$\Delta S_{a,q} = \left(\frac{1}{2} \epsilon_{q,a} \frac{\Delta p}{p} \right) S_{a,q} \quad (1)$$

To calculate the premature deaths averted ($\Delta D_{a,q}$), we used estimates from Doll et al.(40,41) to model the changes in expected mortality based on the age at smoking cessation (r_a), assuming that half of smokers would die from their addiction.(40,42,43) Hence, the number of premature deaths averted would be:

$$\Delta D_{a,q} = \left(\frac{1}{2} \varepsilon_{q,a} \frac{\Delta p}{p} \right) r_a D_{a,q} . \quad (2)$$

While higher prices are also likely to lower the intensity of smoking among continuing smokers, we only calculated the health benefits associated with quitting and did not model any substitution effects of individuals switching to lower price cigarettes.

For OOP and government medical expenditures averted, we allocated the averted premature deaths above (2) to four main causes of deaths: heart disease, neoplasms (lung cancer), stroke, and chronic obstructive pulmonary disease (COPD).(1) Healthcare utilization rates for each cause were estimated using the total annual number of hospitalizations by the International Statistical Classification of Diseases and Related Health Problems (ICD-10) group in the Ministry of Health 2015 Statistical Yearbook for Armenia (44) and the prevalence rates of the four diseases as estimated by the Institute for Health Metrics and Evaluation.(1) To estimate hospitalizations by quintile, we used data on quintile-specific utilization rates for inpatient services from the 2014 ILCS.(24) The utilization rates were normalized using the middle consumption quintile as a reference and applied to the disease-specific hospitalization rates. The average cost of treatment per disease was obtained from Armenia's basic benefits package (BBP) price list.(45) The BBP fully funds services for socially vulnerable groups, including the poor and those with disabilities.(46) According to the 2014 ILCS data,(24) almost 28 percent of the population is eligible for the BBP. We assumed that the government would pay the full cost of tobacco-related disease treatment for those covered by the BBP and that these individuals would not incur any additional expenses. Individuals who are not eligible for the BBP would pay the full BBP price out of pocket. The change in OOP spending per quintile as a result of tax hike would be:

$$\Delta OOP_q = (1 - B_q) \left(\sum_a \Delta D_{a,q} \sum_d P_d u_{d,q} C_d \right) , \quad (3)$$

where B_q represents the share of population covered by the BBP in quintile q , P_d is the contribution (in %) of disease d to tobacco-related premature deaths, C_d is the cost of treatment for disease d , and $u_{d,q}$ is the utilization of health services for disease d per quintile q . Likewise, government savings as a result of averted deaths among those covered by BBP would be:

$$Govt_{savings,q} = B_q \left(\sum_d \Delta D_{d,q} \sum_d P_d u_{d,q} C_d \right) . \quad (4)$$

Note that we did not estimate potential health care costs that would be incurred as a result of years of life gained among quitters. Previous studies, however, have suggested that quitting is associated with a reduction in overall health expenditures.(47–49)

For the cases of medical impoverishment (poverty cases) averted, we calculated the number of individuals that would have fallen below the poverty line as a result of OOP tobacco-related disease treatment expenditures. Given that the national poverty line was estimated in per adult equivalent terms,(50) we identified an annual individual consumption cutoff in the simulated consumption distribution corresponding to the 30th percentile (30 percent of the population lived below the poverty line in 2015),(50) which corresponded to approximately 1220 US\$ per year. Hence, we calculated the number of individuals for whom the simulated annual consumption was above this poverty line, but whose annual net consumption would have decreased to < 1220 US\$ after paying for tobacco-related disease treatment. Likewise, for averted cases of catastrophic health expenditures, we calculated the number of individuals for whom OOP expenditures on tobacco-related disease treatment would be greater than 10 percent of annual individual consumption.

In addition to the scenario of moving up to a 75 percent excise tax rate, we studied two additional scenarios i.e. shifts to a 50 percent excise tax rate (i.e., a 25 percent price increase) and to a 100 percent excise tax rate (i.e., 65 percent price increase). We also conducted a few sensitivity analyses. First, we tested the price elasticity of demand for tobacco, by applying a flat price elasticity of -0.54 to all quintiles. Second, we used two alternative poverty thresholds: a lower poverty line of US\$ 79 per month (or US\$ 948 per annum), and a food

poverty line of US\$ 56 per month (or US\$ 672 per annum).(50) Approximately 10 percent of the population was classified as poor using the lower poverty line and about 2 percent of the population lived below the food poverty line. (50) Third, we used two alternative thresholds in the estimation of cases of catastrophic health expenditures: 20 percent and 40 percent of individual consumption. Table 1 gathers all the input parameters used in the model. All analyses were conducted using R software (R 3.3.2).

Table 1. Data inputs for the modeling of the increase in the tobacco excise tax in Armenia.

INPUT		VALUE	SOURCE
Male population		1,419,370	(33)
Male population distribution, age group (years)	< 15	21%	(33)
	15-24	16%	
	25-44	30%	
	45-64	25%	
	≥ 65	9%	
Individual annual consumption (2014 US\$)	Q1 (poorest)	< 1091	(24)
	Q2	1092-1458	
	Q3	1459-1744	
	Q4	1745-2191	
	Q5 (richest)	> 2191	
Male smoking prevalence, per age group (years)	15-24	38%	(22)
	25-44	67%	
	45-64	58%	
	≥ 65	31%	
Male smoking prevalence, by wealth quintile	Q1 (poorest)	49%	(22)
	Q2	61%	
	Q3	59%	
	Q4	49%	
	Q5 (richest)	42%	
Daily cigarette consumption		24 Cigarettes	(22)
Price per pack of cigarettes (2014 US\$)		\$1.25	(7)
Tobacco-related disease treatment costs (2014 US\$)	COPD	\$424	(45)
	Stroke	350	
	Heart disease	1724	
	Neoplasm (lung cancer)	4781	

INPUT		VALUE	SOURCE
Share of population eligible for the publically financed basic benefits package (%), by consumption quintile	Q1 (poorest)	40%	(24,64)
	Q2	30%	
	Q3	27%	
	Q4	23%	
	Q5 (richest)	19%	
Utilization rates of healthcare services per tobacco-related disease	Neoplasms	40%	Authors' calculations based on (44)
	Circulatory systems diseases	75%	
	Respiratory systems disease	27%	
Relative use of healthcare services by consumption quintile (standardized to use Q3 as a reference)	Q1 (poorest)	0.72	Authors' calculations based on (24)
	Q2	0.73	
	Q3	1	
	Q4	1.06	
	Q5 (richest)	1.17	
Reduction in mortality risk by age (age group in years) at quitting smoking	15-24	97%	(40)
	25-44	85%	
	45-64	75%	
	≥ 65	25%	
Price elasticity of demand for tobacco products, by consumption quintile	Q1 (poorest)	-0.74	Authors' assumption based on estimates from Kyrgyzstan (36)
	Q2	-0.65	
	Q3	-0.65	
	Q4	-0.46	
	Q5 (richest)	-0.28	
National monthly poverty line		41,698 AMD (\$100)	(50)
National poverty rate (percent of population)		30%	(50)

Stakeholder interviews

Following Bump and Reich (51), to gain a better understanding of the circumstances in which the current tax hike was proposed, we also conducted a series of interviews with Armenian stakeholders. We focused on the two stages of the policy cycle: the initial placement on the policy agenda or “agenda setting” and the technical design of the reform proposal.(52,53)

Qualitative data for this analysis were collected through semi-structured interviews, as well as published and grey literature on Armenia’s tobacco control efforts. We used a purposeful sampling approach to identify interviewees by constructing a preliminary list of stakeholders prior to arriving in Armenia based on a literature review of tobacco control efforts in Armenia. The interviews were conducted in Yerevan in June 2016. Interviewees included representatives from the Ministry of Health (n=3), international organizations (n=3), health professionals (n=2), local non-governmental organizations (NGOs) (n=2), and universities (n=1). In total, we interviewed eleven individuals (Table 2), using a semi-structured interview guide, although stakeholders were encouraged to talk generally about tobacco control efforts in Armenia. Contemporaneous notes were taken during the interviews, and content analysis was performed once all interviews were completed to identify relevant themes to the research question. This work was supplemented by information and data extracted from national surveys, news releases, and published research relating to tobacco control in Armenia. The Harvard Human Research Protection Program granted an exemption for this study.

Table 2. Number of interviews conducted with key stakeholders.

Stakeholder group	Number of interviews
Ministry of Health	3
Health professionals	2
International organizations	3
Local non-governmental organizations	2
Universities	1
Total	11

Results

Distributional impact

Increasing the price of cigarettes by 45 percent would avert approximately 88,000 premature deaths among current estimated quitters and non-initiators (Table 3). Half of the premature deaths averted would be concentrated among the bottom two quintiles, with only 10 percent of deaths averted from the richest quintile. This is largely driven by the higher price elasticity among the poor (almost 2.6 times higher among the poorest than the richest quintile). In the sensitivity analyses, when assuming a flat price elasticity of -0.54 across all quintiles, unsurprisingly, while the total number of premature deaths averted would remain similar at about 86,000, its distribution would be more uniform across quintiles and in line with the quintile-specific smoking rates. Almost 20 percent of deaths would be averted in the richest quintile compared to 17 percent in the poorest quintile (Supplementary webappendix, Table A.1).

Table 3. Extended cost-effectiveness analysis results by individual consumption quintile for a shift to a 75% tobacco excise tax rate (equivalent to a 45% price increase).

	TOTAL	Q1 (poorest)	Q2	Q3	Q4	Q5 (richest)
Premature deaths averted (in 1000s)	88 (71, 106)	21 (17, 25)	23 (18, 28)	22 (18, 27)	13 (11, 16)	9 (7, 10)
Out-of-pocket expenditures related to tobacco-related disease treatment averted (million US\$)	63 (51, 77)	10 (8, 12)	13 (11, 16)	19 (15, 22)	12 (10, 15)	9 (7, 11)
Government savings related to tobacco-related disease treatment averted (million US\$)	26 (20, 30)	7 (6, 8)	6 (5, 7)	7 (5, 8)	4 (3, 4)	2 (2, 3)
Poverty cases averted (in 1000s)	22 (18, 27)	0 0	6 (5, 7)	8 (7, 10)	5 (4, 6)	3 (2, 3)
Cases of catastrophic health expenditures (>10% of consumption) averted (in 1000s)	33 (28, 40)	5 (4, 6)	7 (6, 8)	8 (8, 12)	6 (5, 8)	5 (4, 6)

Note: No poverty cases are averted in the poorest consumption quintile given that 30% of the population is already below the poverty line. Lower and upper bounds are indicated in parentheses.

There would also be substantial savings in OOP and government medical spending. As a result of averted tobacco-related disease treatment costs among those eligible for the BBP, the government would save a total of approximately US\$ 26 million. In addition, almost US\$ 63 million of OOP expenditures related to tobacco-related disease treatment would be averted among those not covered by the BBP. Almost 37 percent of these OOP savings would accrue to the bottom two quintiles, with an additional 30 percent accruing to the middle quintile in which fewer individuals were eligible for the BBP. When we assumed a flat price elasticity by quintile, OOP savings were slightly larger in magnitude (US\$ 67 million), and almost 27 percent of those would accrue to the richest quintile compared to 28 percent in the bottom two quintiles (Supplementary webappendix, Table A.1).

With a 45 percent tobacco price increase, almost 22,000 poverty cases would be averted. Given that 30 percent of the population already lived below the poverty line, no poverty cases would be averted among this bottom 30 percent of the population. Almost 27 percent of the averted poverty cases would accrue to the second poorest quintile and 14 percent to the richest quintile. Testing the sensitivity to the poverty threshold retained in the estimation, our results indicate that under a lower poverty line of about US\$ 948 per year, the number of poverty cases averted would slightly rise to 23,000; under the food poverty line of US\$ 672 per year, 24,000 poverty cases would be averted (Supplementary webappendix, Table A.2). Similarly, almost 33,000 cases of catastrophic health expenditures (defined as health spending representing more than 10 percent of individual consumption) would be averted.

Stakeholder interviews

Tobacco control efforts in Armenia have diminished after FCTC ratification. (26) Despite the existence of FCTC-recommended policies, the government has not been able to strengthen tobacco control measures, particularly in relation to raising excise taxes on tobacco products. In our interviews, all stakeholders emphasized that Armenia was the first among the former Soviet Union countries to ratify the FCTC. The early push for tobacco control measures in Armenia was largely attributed to former President Robert Kocharyan, himself a non-smoker, who strongly advocated for the FCTC implementation and encouraged other government members to quit smoking. In the absence of a strong public supporter, the importance of tobacco control measures subsided after Kocharyan left office in 2008. While

the Ministry of Health was a proponent of stronger tobacco control measures, particularly increased taxation, most interviewees suggested that it was not a powerful player in discussions on fiscal policy. In addition, the tobacco industry previously held a strong lobby in the Parliament, with several former tobacco industry executives having served on the Parliamentary Standing Committee on Financial Credit and Budgetary Affairs and Standing Committee on Economic Affairs. This resulted in several draft laws on tobacco control measures being recalled from the Parliament.

Economic pressures, however, presented a window of opportunity for an overhaul of the existing tax system. In 2015, Armenia was facing continuing fiscal constraints, and the World Bank and the International Monetary Fund (IMF) supported measures to raise additional revenues.⁽²⁰⁾ In addition, Armenia's accession to the Eurasian Economic Union in 2015 resulted in its own set of tax measures and regulations, including the mandated harmonization of rates of excise duties on alcohol and tobacco products over the next five years.^(54,55) As a result, in October 2015, the government approved a package of draft laws on the tax code, which placed tobacco excise taxes on the government agenda. More specifically, the recently amended and approved tax code mandates that excise rates for alcohol and tobacco are to increase by 15 percent per year over 2017-2021, resulting in a tobacco excise tax of 44 percent by 2021.⁽²⁰⁾

Based on the discussions with key stakeholders and a literature review, it became evident that unlike previous unsuccessful attempts, two important contextual factors helped to garner support for the inclusion of higher excise tobacco taxes in the new tax code: tobacco tax increases were included alongside tax increases on other goods and services, including labor income tax; and it was seen as an inevitable step for the harmonization of taxes in the Eurasian Economic Union.

The design of the tax reforms in Armenia was based on two key principles: the new tax system should enhance growth and equity; and it should generate revenue to support fiscal consolidation and allow higher social and capital expenditures.^(20,56) In relation to tobacco excise taxes, the focus on equity was particularly important. Based on the discussions with stakeholders, regressivity appeared to be an important factor in delaying increased tobacco taxes since FCTC ratification. To address the equity concerns, the World Bank and the IMF provided technical assistance to simulate various scenarios

of proposed tax increases on various products, including tobacco.(20,56) Experience from other countries, such as the Philippines, played an important role in assuaging the regressivity concerns and allowing the Ministry of Finance to move forward with the proposed changes.

Regressivity more so than any other commonly used argument against tobacco taxation – such as loss of revenues or smuggling – was at the center of the tobacco tax discussion. In several interviews, stakeholders stated that Armenia had strong tax and customs administration systems. Tobacco products, as other goods and imports, have holographic labels and unique identification codes; and tax officers commonly make sample purchases to scan and test the information provided on the products. This was argued to be a strong deterrent to smuggling. In addition, two individuals interviewed cited the ease of tobacco tax increases. Unlike other proposed tax changes, the interviewees noted that tobacco and alcohol taxes were easier to enforce and did not require any additional regulation. As a result, the higher tobacco and alcohol taxes entered into force on January 1, 2017, while the remaining changes to the budget code will be implemented in the following year.(20)

While several interviewees cited examples from the Philippines and Thailand, where tobacco and alcohol taxes are earmarked for health, the possibility of earmarking was not discussed at length, and few interviewees supported this idea. Stakeholders cited the danger of setting a precedent, which would result in other ministries and government agencies requesting their own earmarked sources. In addition, one stakeholder cited the unsuccessful attempt to earmark proceeds from a VAT on medicines for health in 2001 as a reason why earmarking tobacco taxes would not be a viable policy in Armenia. Therefore, the discussion of earmarking was not pursued extensively for tobacco taxes.

Tobacco tax was seen as an important measure to reduce consumption, but all stakeholders emphasized that other FCTC measures should be enforced. They stressed in particular the importance of raising public awareness and enforcing smoke-free zones. Moreover, they indicated that while they supported further tobacco tax increases, they believed that national cessation support services (currently not available in Armenia) should follow in order to realize the full benefits of higher prices for cigarettes.

Discussion

The ECEA results indicate that higher excise taxes on tobacco in Armenia would avert large numbers of premature deaths and poverty cases. With a hike to a 75 percent excise tax rate, 88,000 premature deaths, US\$ 63 million of OOP medical expenditures, 22,000 poverty cases (or 33,000 cases of catastrophic health expenditures) would be averted. Because the poor are more sensitive to price changes, the health benefits would be concentrated among the bottom two consumption quintiles of the population. Given that a larger share of the poor are eligible for the BBP and thus exempt from OOP payments, the benefits of averted tobacco-related disease treatment costs would accrue to the middle quintiles 3 and 4, less than 30 percent of whom are BBP-eligible. Government savings on tobacco-related treatment costs for those BBP-eligible would amount to US\$ 26 million, which represents almost 12 percent of the annual health budget (estimated at US\$ 220 million in 2014).(23)

The fiscal constraints faced by the government and the accession to the Eurasian Economic Union in 2015 mandated a comprehensive overhaul of the existing tax policy and created a window of opportunity for tobacco tax increases. While previous attempts to increase tobacco taxes were unsuccessful in part due to veto power in the Parliament, the comprehensive nature of the tax reform allowed tobacco measures to be included in the proposal. Despite initial concerns about the regressivity of tobacco taxes, the findings from stakeholder interviews suggested that experience from other countries and simulations of the potential impact of such taxes on the poor were strong arguments for raising tobacco taxes as part of the overall fiscal reform. Our case study of Armenia presents evidence of what would be a successful attempt to increase tobacco excise taxes as part of a broader reform of a governmental tax system, yet the proposed excise tax of 44 percent (to be achieved by 2021) remains well below WHO's recommendations.

Nevertheless our analysis presents a number of limitations. First, we were not able to calculate the price elasticity of demand for tobacco products in Armenia, and our model was based on price elasticity estimates from the Kyrgyz Republic. Yet, the Kyrgyz price elasticities fell within the range of elasticities estimated in developing countries.(8) In addition, to test the sensitivity of our findings to price elasticity assumptions, we also simulated impact using a flat price elasticity across all quintiles. Second, we did not model substitution effects of individuals switching to lower-priced cigarettes as a result of price increases. However, unlike other types of taxes, high specific excise taxes would narrow the price gap between the most and least expensive cigarettes and encourage cessation rather than substitution to lower-priced

cigarettes as a result of tax increases.(9,13). Third, we assumed that a decline in the intensity of smoking would not yield any health benefits: individuals who would reduce their tobacco consumption and smoke fewer cigarettes per day as a result of tax hike would not improve their health outcomes in our model; nor did we model second-hand smoking. As a result, we are likely to underestimate the full impact of higher tobacco taxes in our premature deaths and financial risk protection findings. Fourth, in the absence of data on OOP expenditures per disease, we used the BBP price list as a proxy for the incurred OOP expenditures. Although this is the official government price for services in all government facilities, there is some evidence of informal payments.(57) In addition, data on pharmaceutical expenditures on medicines not covered by the BBP were not available and hence could not be included. Our results thus are likely to underestimate the expenditures related to tobacco-related disease treatment and the number of poverty cases averted, since OOP medical expenditures are likely to be higher than the established government fees for the BBP. Fifth, we only included the cost of inpatient care, as we were not able to obtain detailed data on utilization for each disease and associated costs at the primary health care level. Primary care, however, is free for all citizens in Armenia. Therefore individuals should not incur any OOP at the primary care level. Sixth, the health and health-related financial benefits are modeled into the future (for the current Armenian male population), when individuals are expected to face tobacco-related diseases. Hence, there is wide uncertainty in our assumptions, as we assume that key inputs (e.g., consumption, cost of medical services, utilization, BBP coverage) remain the same. Seventh, we assumed that the excise tax would be passed fully onto the consumer. Although this is a standard assumption in tobacco tax modeling studies,(6,8) the empirical evidence is mixed,(8,58–61) hence we may overestimate here the effect of increased excise taxes.

Our study contributes to the literature on tobacco taxation and the distributional impact of higher cigarette prices and taxes. While the regressivity argument has been commonly used against price increases and was perceived to be a constraint to increase tobacco taxes in Armenia, similarly to other recent studies we do not find evidence of higher tobacco prices necessarily disproportionately burdening the poor. As recent studies have found, the higher responsiveness to prices among the poor may shift the burden of incremental taxes to the rich, thus making tobacco taxes more progressive.(31,32,62) Not only can higher excise taxes reduce the number of deaths through smoking cessation,(63) but they can also decrease potential OOP expenditures on treatment for tobacco-related disease. Given the large costs associated with such treatment, by encouraging smokers to quit or averting initiation, tobacco taxes can bring substantial financial risk protection to individuals by preventing such OOP medical expenditures altogether.(31)

While the health benefits associated with smoking cessation have been well established, this has not been necessarily enough to encourage countries to raise tobacco taxes. Identifying the potential windows of opportunities (e.g. fiscal constraints) has important policy implications and could enable a push for higher tobacco taxes. As the global health community encourages the use of fiscal policies to change behavior (e.g. tobacco taxes, sugar-sweetened beverage taxes) in order to achieve public health gains, the sole public health argument might be insufficient. The case of Armenia suggests that governments could successfully increase tobacco taxes by including them as part of broader fiscal reforms. While the proposal to raise excise taxes in Armenia marks an important step, the proposed rate of 44 percent remains well below the WHO recommendation. Concerted efforts need to be taken in order to ensure that further tax increases are implemented and other tobacco control measures are enacted according to the FCTC and best practices.

References

1. Institute for Health Metrics and Evaluation. GBD Compare | IHME Viz Hub [Internet]. 2017 [cited 2016 Nov 18]. Available from: <http://vizhub.healthdata.org/gbd-compare>
2. Bloom DE, Cafiero E, Jané-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S, et al. *The global economic burden of noncommunicable diseases*. Program on the Global Demography of Aging; 2012.
3. Goodchild M, Nargis N, d'Espaignet ET. 2017. Global economic cost of smoking-attributable diseases. *Tob Control*. 2017.
4. World Health Organization. WHO Framework Convention on Tobacco Control [Internet]. 2003 [cited 2016 Nov 21]. Available from: <http://apps.who.int/iris/bitstream/10665/42811/1/9241591013.pdf>
5. United Nations. Sustainable Development Goals [Internet]. 2015 [cited 2016 Nov 21]. Available from: <http://www.un.org/sustainabledevelopment/health/>
6. U.S. National Cancer Institute, World Health Organization. *The Economics of Tobacco and Tobacco Control*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute; and Geneva, CH: World Health Organization; 2016. Report No.: NIH Publication No. 16-CA-8029A.
7. World Health Organization. *WHO Report on the Global Tobacco Epidemic, 2015*. Geneva: World Health Organization; 2015.
8. International Agency for Research on Cancer. *IARC Handbooks of Cancer Prevention, Tobacco Control, Volume 14: Effectiveness of Tax and Price Policies in Tobacco Control*. Vol. 14. Lyon, France: International Agency for Research on Cancer; 2011.
9. Chaloupka FJ, Hu T, Warner KE, Jacobs R, Yurekli A. The taxation of tobacco products. In: Jha P, Chaloupka FJ, editors. *Tobacco Control in Developing Countries*. New York: Oxford University Press; 2000.
10. Jha P, Chaloupka FJ. *Curbing the epidemic: governments and the economics of tobacco control*. Washington, D.C.: World Bank Publications; 1999.
11. Addis Ababa Action Agenda of the Third International Conference on Financing for Development 13-16 July, 2015 [Internet]. Addis Ababa, Ethiopia; [cited 2016 Nov 16]. Available from: http://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAA_Outcome.pdf
12. World Health Organization. *WHO technical manual on tobacco tax administration*. Geneva: World Health Organization; 2010.
13. Jha P, Peto R. Global effects of smoking, of quitting, and of taxing tobacco. *N Engl J Med*. 2014;370(1):60–68.
14. Koh HK. An analysis of the successful 1992 Massachusetts tobacco tax initiative. *Tob Control*. 1996;5(3):220–225.
15. Balbach ED, Herzberg A, Barbeau EM. Political coalitions and working women: how the tobacco industry built a relationship with the Coalition of Labor Union Women. *J Epidemiol Community Health*. 2006;60(suppl 2):ii27–ii32.
16. Smith KE, Savell E, Gilmore AB. What is known about tobacco industry efforts to influence tobacco tax? A systematic review of empirical studies. *Tob Control*. 2013;22(2):144–153.
17. Remler DK. Poor smokers, poor quitters, and cigarette tax regressivity. *Am J Public Health*. 2004;94(2):225–229.
18. World Bank. The World Bank Group Goals: End Extreme Poverty and Promote Shared Prosperity. Washington, D.C.: The World Bank; 2013.
19. World Bank, National Statistical Service of the Republic of Armenia. Social Snapshot and Poverty in Armenia: Based on the results of the 2014 Integrated Living Conditions Survey of Households. Yerevan, Armenia; 2015.
20. International Monetary Fund. Republic of Armenia Third Review Under the Extended Arrangement: Staff Report. 2016 Jul. Report No.: IMF Country Report No. 16/246.
21. National Institute of Health. Assessment of the health system in 2016 [Internet]. Yerevan, Armenia: Ministry of Health Armenia; 2016. Available from: http://moh.am/uploads/HSPA_2016_ARM_2016.pdf
22. Ministry of Health. Armenian National Health Sector Performance Assessment [dataset]. 2015.
23. World Bank. World Development Indicators | Data [Internet]. 2016 [cited 2016 Nov 20]. Available from: <http://data.worldbank.org/data-catalog/world-development-indicators>
24. National Statistical Service of the Republic of Armenia. Armenia Household's Integrated Living Conditions Survey [dataset]. 2014.
25. Law of the Republic of Armenia on the sale, consumption and limiting the use of tobacco [Internet]. HO-72-N Dec 24, 2004. Available from: <http://www.tobaccocontrol.org/files/live/Armenia/Armenia%20-%20Law%20on%20Restrictions%20of%20Sale%2C%20Consumption%2C%20and%20Use.pdf>
26. Movsisyan NK, Connolly GN. Measuring Armenia's progress on the Tobacco Control Scale: an evaluation of tobacco control in an economy in transition, 2005–2009. *BMJ Open*. 2014;4(2):e004410.
27. Ministry of Health of the Republic of Armenia, World Health Organization. Armenia: Reporting Instrument of the WHO Framework Convention on Tobacco Control. 2014.
28. Package of Draft Laws on Tax Code Approved [Internet]. The Government of the Republic of Armenia: Official News. 2015 [cited 2016 Dec 19]. Available from: <http://www.gov.am/en/news/item/8122/>
29. Verguet S, Laxminarayan R, Jamison DT. Universal Public Finance of Tuberculosis Treatment in India: An Extended Cost-Effectiveness Analysis. *Health Econ*. 2015;24(3):318–332.
30. Verguet S, Kim JJ, Jamison DT. Extended cost-effectiveness analysis for health policy assessment: a tutorial. *PharmacoEconomics*. 2016;34(9):913–923.
31. Verguet S, Gauvreau CL, Mishra S, MacLennan M, Murphy SM, Brouwer ED, et al. The consequences of tobacco tax on household health and finances in rich and poor smokers in China: an extended cost-effectiveness analysis. *Lancet Glob Health*. 2015;3(4):e206–e216.
32. Salti N, Brouwer E, Verguet S. The health, financial and distributional consequences of increases in the tobacco excise tax among smokers in Lebanon. *Soc Sci Med*. 2016;170:161–169.
33. World Bank. Health, Nutrition and Population Data and Statistics [Internet]. 2016 [cited 2016 Nov 21]. Available from: <http://datatopics.worldbank.org/hnp/>
34. Kemp-Benedict E. Income distribution and poverty: methods for using available data in global analysis. PoleStar Technical Note 4, 2001.
35. Salem A, Mount T. A convenient descriptive model of income distribution: the gamma density. *Econometrica* 1974;1115–1127.
36. National Statistical Committee of the Kyrgyz Republic. Kyrgyz Integrated Household Survey [dataset]. 2015.
37. Hu T-W, Ren Q-F, Keeler TE, Bartlett J. The demand for cigarettes in California and behavioural risk factors. *Health Econ*. 1995;4(1):7–14.
38. Adioetomo SM, Djutaharta T, Hendratno. Cigarette consumption, taxation, and household income: Indonesia case study. Washington, D.C.: World Bank; 2005. (Health Nutrition and Population (HNP) discussion paper).

39. World Health Organization. *WHO technical manual on tobacco tax administration*. Geneva: World Health Organization; 2010.
40. Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years' observations on male British doctors. *Bmj*. 2004;328(7455):1519.
41. Verguet S, Tarr G, Gauvreau C, Mishra S, Jha P, Liu L, et al. Distributional benefits of tobacco tax and smoke-free workplaces in China: a modeling study [forthcoming].
42. Jha P, Jacob B, Gajalakshmi V, Gupta PC, Dhingra N, Kumar R, et al. A nationally representative case-control study of smoking and death in India. *N Engl J Med*. 2008;358(11):1137–1147.
43. Jha P, Ramasundarathettige C, Landsman V, Rostron B, Thun M, Anderson RN, et al. 21st-century hazards of smoking and benefits of cessation in the United States. *N Engl J Med*. 2013;368(4):341–350.
44. National Institute of Health of Armenia. Health and Wellness Statistical Yearbook 2015 [Internet]. Yerevan, Armenia: Ministry of Health Armenia; 2016. Available from: http://moh.am/uploads/Health_Health%20Care%20Year%20Book_2015_Arm.pdf
45. Ministry of Health of the Republic of Armenia. Armenia Basic Benefits Package Price List. 2016.
46. Richardson E. Armenia: Health system review. *Health Syst Transit*. 2013;15(4):1–99.
47. Hodgson TA. Cigarette smoking and lifetime medical expenditures. *Milbank Q*. 1992;81–125.
48. Fishman PA, Khan ZM, Thompson EE, Curry SJ. Health care costs among smokers, former smokers, and never smokers in an HMO. *Health Serv Res*. 2003;38(2):733–749.
49. Rasmussen SR, Prescott E, Sørensen TI, Søgaard J. The total lifetime health cost savings of smoking cessation to society. *Eur J Public Health*. 2005;15(6):601–606.
50. World Bank, National Statistical Service of the Republic of Armenia. Social Snapshot and Poverty in Armenia: Based on the results of the 2015 Integrated Living Conditions Survey of Households. [Internet]. Yerevan, Armenia; 2016. Available from: http://www.armstat.am/file/article/poverty_2016_eng_2.pdf
51. Bump JB, Reich MR. Political economy analysis for tobacco control in low-and middle-income countries. *Health Policy Plan*. 2013;28(2):123–133.
52. Kaufman RR, Nelson JM, others. *Crucial needs, weak incentives: social sector reform, democratization, and globalization in Latin America*. Washington, D.C.: Woodrow Wilson Center Press; 2004.
53. Roberts MJ. Getting Health Reform Right : A Guide to Improving Performance and Equity [Internet]. Oxford: Oxford University Press; 2004 [cited 2012 Sep 14]. Available from: <http://web.ebscohost.com.ezp-prod1.hul.harvard.edu/ehost/detail?sid=d438bcc6-8315-4a84-8016-0e18aabdf879%40sessionmgr15&vid=1&hid=21&bdata=JnNpdGU9ZWhvc3QtGjZSZZy29wZT1zaXRl#db=nlebk&AN=176907>
54. Eurasian Economic Commission. On the Draft Agreement on the tax policy principles in respect of excise duties on tobacco products in the Member States of the Eurasian Economic Union [Internet]. Order № 126 Nov 10, 2015. Available from: <http://www.eurasiancommission.org/ru/Lists/Decisions/DispForm.aspx?ID=531>
55. Draft Agreements on the tax policy principles in respect of excise duties on alcohol and tobacco products in the EAEU Member States are approved [Internet]. Eurasian Economic Commission. 2015 [cited 2016 Dec 19]. Available from: <http://www.eurasiancommission.org/en/nae/news/Pages/29-10-2015-5.aspx>
56. Gohar Gyulumyan. Is it Fair that 80-85 Percent of Personal Income Tax Collections is Formed through Those Earning Less than AMD 120 Thousand Income per Month? [Internet]. 2016 [cited 2016 Dec 19]. Available from: <http://www.worldbank.org/en/news/opinion/2016/07/01/interview-with-ms-gohar-gyulumyan-on-the-tax-code>
57. Lewis M. Informal payments and the financing of health care in developing and transition countries. *Health Aff (Millwood)*. 2007;26(4):984–997.
58. Linegar DJ, van Walbeek C. The effect of excise tax increases on cigarette prices in South Africa. *Tob Control*. 2017.
59. Hanson A, Sullivan R. The incidence of tobacco taxation: evidence from geographic micro-level data. *Natl Tax J*. 2009;677–698.
60. Sullivan RS, Dutkowsky DH. The effect of cigarette taxation on prices: an empirical analysis using local-level data. *Public Finance Rev*. 2012;40(6):687–711.
61. Delipalla S, O'Donnell O. Estimating tax incidence, market power and market conduct: The European cigarette industry. *Int J Ind Organ*. 2001;19(6):885–908.
62. Fuchs A, Meneses F. Are Tobacco Taxes Really Regressive? Washington, D.C.: World Bank; 2017.
63. Jha P, Joseph R, Li D, Gauvreau C, Anderson I, Moster P, et al. Tobacco Taxes: A Win-win Measure for Fiscal Space and Health. November 2012. 2012.
64. Jamal S. Improvements in Targeting of Basic Benefits Package in Armenia. 2016.
65. Adioetomo S, Djutaharta T, Hendratno. Cigarette consumption, taxation and household income: Indonesia case study. World Bank Health Nutr Popul HNP Discuss Pap Econ Tob Control Pap. 2005;(26).

Supplementary appendix

Table A.1. Extended cost effectiveness analysis results by individual consumption quintile for a shift to a 75% excise tobacco tax rate (equivalent to a 45% price increase) assuming a flat price elasticity (same price elasticity across all quintiles).

	TOTAL	Q1 (poorest)	Q2	Q3	Q4	Q5 (richest)
Premature deaths averted (in 1000s)	86 (68, 102)	15 (12, 18)	19 (15, 23)	19 (15, 22)	16 (12, 19)	17 (13, 20)
Out-of-pocket expenditures related to tobacco-related disease treatment averted (million US\$)	67 (53, 80)	8 (6, 9)	11 (9, 13)	15 (12, 18)	15 (12, 17)	18 (14, 22)
Government savings related to tobacco-related disease treatment averted (million US\$)	24 (19, 28)	5 (4, 6)	5 (4, 6)	6 (4, 7)	4 (3, 5)	4 (3, 5)
Poverty cases averted (in 1000s)	23 (18, 28)	0 0	5 (4, 6)	7 (6, 8)	6 (5, 7)	5 (4, 6)
Cases of catastrophic health expenditures (>10% of consumption) averted (in 1000s)	35 (28, 42)	4 (3, 5)	6 (5, 7)	8 (6, 10)	8 (6, 9)	9 (7, 11)

Note: No poverty cases are averted in the poorest consumption quintile given that 30% of the population is already below the poverty line. Lower and upper bounds are indicated in parentheses.

Table A.2. Extended cost effectiveness analysis results by individual consumption quintile for a shift to a 75% excise tobacco tax rate (equivalent to a 45% price increase) using: lower and food poverty lines; 20% and 40% thresholds for catastrophic health expenditures.

	TOTAL	Q1 (poorest)	Q2	Q3	Q4	Q5 (richest)
<i>Poverty cases averted</i>						
Using lower poverty line of 79 US\$ per month (in 1000s)	23 (19, 28)	1 (1, 2)	7 (5, 8)	8 (6, 9)	5 (4, 6)	2 (2, 3)
Using food poverty line of 56 US\$ per month (in 1000s)	24 (19, 28)	4 (3, 5)	6 (5, 7)	8 (6, 9)	5 (4, 6)	1 (1, 2)
<i>Cases of catastrophic health expenditures averted</i>						
Using a threshold of >20% of individual consumption (in 1000s)	32 (25, 38)	5 (4, 6)	7 (6, 8)	10 (8, 12)	6 (5, 7)	4 (3, 5)
Using a threshold of >40% of individual consumption (in 1000s)	27 (22, 33)	5 (4, 6)	6 (5, 7)	8 (6, 9)	5 (4, 6)	4 (3, 5)

Note: The lower and food poverty lines are two alternative measures used for poverty calculations in Armenia. In 2014, approximately 10% and 2% of the population fell below the lower and food poverty lines, respectively.⁽⁵⁰⁾ Lower and upper bounds are indicated in parentheses.

Table A.3. Extended cost effectiveness analysis results by individual consumption quintile for shifts to 50% and 100% excise tobacco tax rates (equivalent to 25% and 65% price increases, respectively).

	TOTAL	Q1 (poorest)	Q2	Q3	Q4	Q5 (richest)
<i>50% excise tax rate or 25% price increase</i>						
Premature deaths averted (in 1000s)	75 (61, 91)	18 (15, 22)	20 (16, 24)	19 (15, 23)	11 (9, 14)	7 (6, 9)
Out-of-pocket expenditures related to tobacco-related disease treatment averted (million US\$)	24 (44, 66)	4 (7, 11)	6 (9, 14)	8 (13, 19)	5 (9, 13)	1 (7, 10)
Government savings related to tobacco-related disease treatment averted (million US\$)	22 (17, 26)	6 (5, 7)	5 (4, 6)	6 (5, 7)	3 (3, 4)	2 (2, 2)
Poverty cases averted (in 1000s)	18 (15, 23)	0 (0)	5 (4, 6)	7 (6, 9)	4 (4, 5)	2 (2, 3)
Cases of catastrophic health expenditures (>10% of consumption) averted (in 1000s)	29 (23, 35)	5 (4, 6)	6 (5, 7)	8 (7, 10)	6 (5, 7)	4 (3, 5)
<i>100% excise tax rate or 65% price increase</i>						
Premature deaths averted (in 1000s)	100 (80, 121)	24 (19, 29)	26 (21, 31)	25 (23, 30)	15 (12, 18)	10 (8, 12)
Out-of-pocket expenditures related to tobacco-related disease treatment averted (million US\$)	73 (58, 87)	12 (9, 12)	15 (12, 18)	21 (17, 25)	14 (11, 17)	11 (9, 13)
Government savings related to tobacco-related disease treatment averted (million US\$)	28 (23, 34)	8 (6, 9)	6 (5, 8)	8 (6, 9)	4 (3, 5)	2 (2, 3)
Poverty cases averted (in 1000s)	26 (20, 30)	0 (0)	7 (5, 8)	10 (8, 11)	6 (5, 7)	3 (3, 4)
Cases of catastrophic health expenditures (>10% of consumption) cases averted (in 1000s)	37 (30, 46)	6 (5, 7)	8 (6, 10)	11 (9, 13)	7 (6, 9)	5 (4, 7)

Note: No poverty cases are averted in the poorest consumption quintile given that 30% of the population is already below the poverty line. Lower and upper bounds are indicated in parentheses.

Estimating price elasticity of demand for tobacco in the Kyrgyz Republic

Data from the 2015 Kyrgyz Integrated Household Survey (KIHS) were used to estimate price elasticities for tobacco. First, in order to estimate the price of cigarettes faced by nonsmokers, using an OLS regression we predicted the price of cigarettes for nonsmokers based on the individual's consumption quintile, oblast, and whether the individual resided in an urban or rural area. We assumed that non-smokers faced the predicted price. Following Hu et al.(37) and Adioetomo et al.(65), we used a two-part model to estimate the elasticities. In the first part, we estimated the probability of an individual being a smoker $Prob(C_i = 1)$ using the following logit equation:

$$Prob(C_i = 1) = \frac{1}{1 + e^{-(\delta_1 \ln P_i + \alpha X_i + U_1)}} \quad , \quad (1)$$

where $\ln P_i$ is the log price of cigarettes faced by the individual, X_i is the vector of socio-demographic characteristics, including age, sex, consumption quintile, and oblast, and U_1 is the random error term.

In the second part, we used ordinary least squares regression to estimate the amount of cigarettes smoked per day by current smokers ($\ln(Cig_i | C_i = 1)$):

$$\ln(Cig_i | C_i = 1) = \delta_2 \ln P_i + \alpha X_i + U_2 \quad (2)$$

The total price elasticity ε was calculated as:

$$\varepsilon = (1 - Prob(C_i = 1))\delta_1 + \delta_2 \quad (3)$$

where δ_1 is the coefficient for log(price) in eq. 1 and δ_2 is the coefficient for log(price) in eq. 2. The elasticity was calculated for the whole sample, as well as independently for each consumption quintile.

Table 1 presents the estimated elasticities. The overall price elasticity is -0.54. This price elasticity is consistent with findings from other studies, which have found elasticities ranging from -0.4 to -0.8.⁽⁸⁾ Similarly to findings from other studies,^(8,32) we also found that price elasticities varied across quintiles, with the poor more responsive to prices than the rich (elasticities of -0.74 and -0.28 in quintiles 1 and 5, respectively).

Table A.4: Estimated price elasticities of demand in the Kyrgyz Republic, 2015

Consumption Quintile	Elasticity
Quintile 1 (poorest)	-0.74
Quintile 2	-0.65
Quintile 3	-0.65
Quintile 4	-0.46
Quintile 5 (richest)	-0.28
Total	-0.54

Source: Authors' calculations using Kyrgyz Integrated Household Survey 2015

