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Impact on cardiovascular disease events of the implementation of Argentina's national tobacco control law

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Abstract

Background—Argentina's congress passed a tobacco control law that would enforce 100% smoke-free environments for the entire country, strong and pictorial health warnings on tobacco products and a comprehensive advertising ban. However, the Executive Branch continues to review the law and it has not been fully implemented. Our objective was to project the potential impact of full implementation of this tobacco control legislation on cardiovascular disease.

Methods—The Coronary Heart Disease (CHD) Policy Model was used to project future cardiovascular events. Data sources for the model included vital statistics, morbidity and mortality data, and tobacco use estimates from the National Risk Factor Survey. Estimated effectiveness of interventions was based on a literature review. Results were expressed as life-years, myocardial infarctions and strokes saved in an 8-year-period between 2012 and 2020. In addition we projected the incremental effectiveness on the same outcomes of a tobacco price increase not included in the law.

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Contributors JK undertook the literature review, designed the study, modelled the data, interpreted the results and drafted of the paper. DF undertook the literature review, designed the study, modelled the data and drafted the paper. RM designed the study and drafted the paper. PC modelled the data and drafted the paper. AM designed the study and drafted the paper. LG designed the study and drafted the paper. EPS designed the study and drafted the paper.

Competing interests None.

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Data sharing statement Supplementary data is available in appendix 1. Additional data may be sent upon request.

Correction notice This article has been corrected since it was published Online First. The title of Table 1 has been modified to 'Model inputs for the CHD Policy Model Argentina'. Also, in Table 2, the row 'health warnings' has been changed to 'Health warnings'.

Results—In the period 2012–2020, 7500 CHD deaths, 16 900 myocardial infarctions and 4300 strokes could be avoided with the full implementation and enforcement of this law. Annual per cent reduction would be 3% for CHD deaths, 3% for myocardial infarctions and 1% for stroke. If a tobacco price increase is implemented the projected avoided CHD deaths, myocardial infarctions and strokes would be 15 500, 34 600 and 11 900, respectively.

Conclusions—Implementation of the tobacco control law would produce significant public health benefits in Argentina. Strong advocacy is needed at national and international levels to get this law implemented throughout Argentina.

INTRODUCTION

Cardiovascular diseases are the leading cause of death in the world.[1] Tobacco use is the single most preventable cause of death[2] and the promotion of interventions to reduce tobacco use is among the objectives of the WHO Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases.[1] The WHO Framework Convention on Tobacco Control (FCTC)[3] and the MPOWER package[2] recommend that countries adopt effective tobacco control interventions. Although tobacco use causes 5 million deaths annually, the set of tobacco control interventions that have proven to be effective only protect 5% of the World's population.[2]

The situation in Argentina is similar. Although Argentina's Congress did not ratify the FCTC despite presidential endorsement, several local and provincial governments have enacted smoke-free laws during the last decade. In 2011 the Congress approved a national tobacco control law that included a complete advertising ban, FCTC compliant health warnings and 100% smoke-free environments, applicable to the entire country. However, at this time the national tobacco control law is held up, awaiting authorisation by the Executive Branch before full implementation. If this law is implemented in all provinces, a significant impact on tobacco consumption and related morbidity and mortality could follow in a few years.

Therefore, the aim of this study is to estimate the impact on cardiovascular disease (morbidity and mortality) of the national tobacco control law if it were implemented, and estimate the incremental impact of a price increase on tobacco if implemented in addition to the approved law.

METHODS

To estimate the impact of the interventions we used the Coronary Heart Disease (CHD) Policy Model-Argentina. The CHD Policy Model is a national scale, state-transition (Markov) computer simulation model of the CHD incidence, prevalence, mortality and costs in adults 35–84 years of age.[4] The model has been used to describe the trends in CHD and the effectiveness and cost-savings gained from population-wide policies aimed at tobacco control,[5] and dietary salt.[6] The CHD Policy Model has been successfully adapted to create national cardiovascular disease models for China[7] and Argentina.[8] The model used for this analysis was adapted to also project stroke events in Argentine adults.

The model has three submodels: demographic–epidemiological, bridge and disease-history. The demographic–epidemiological submodel predicts the incidence of CHD and the rates of death due to causes other than CHD among persons without a history of CHD. CHD and stroke events are predicted based on age, sex and the following six factors: smoking status (active smoker or secondhand smoke exposed), systolic blood pressure (SBP), body mass index (BMI), level of high density lipoprotein (HDL) cholesterol, level of low density lipoprotein (LDL) cholesterol and presence or absence of diabetes mellitus. For persons in whom CHD develops, the bridge submodel characterises the initial CHD event and related events for 30 days. The disease-history submodel then predicts the rate of subsequent CHD events and death rates from CHD and deaths not related to CHD among simulated subjects with CHD, with each category stratified according to age, sex and history of events. A summary of data sources for the CHD Policy Model-Argentina follows, but a detailed description of data sources, calibration and mechanics of the methodology used are included in an online appendix.

Data sources for CHD policy model-Argentina

Population—The estimated population of Argentina aged 35–84 years in the year 2010, by age and sex, and 35-year-olds arriving 2011–2020 was obtained from the Argentina National Statistics and Census Institute.[9]

Mortality—Cause-specific mortality data by year, age and sex were obtained from the Statistics and Information Department, Ministry of Health[10] for the years 1997–2009. The CHD Policy Model-Argentina defined CHD as myocardial infarction (MI) (ICD-10 I21, I22), angina and other CHD (ICD-10 I20, I23-I25), and a fixed proportion of poorly defined cardiovascular disease coded events and deaths (ICD-10 I472, I490, I46, I50, I514, I515, I519 and I709). Stroke deaths were defined using ICD-10 codes I60-I69.

Cardiovascular disease incidence, case-fatality, and prevalence—Total stroke incidence, case-fatality, non-cardiovascular death and prevalence were obtained from local data for the CHD Policy Model-Argentina whenever possible. Incidence of acute MI was obtained from a population-based MI registry in a Buenos Aires district[11] and incidence of total stroke from national vital statistics and a hospital admission database maintained by the Ministry of Health of Argentina.[10] Incident cases of stable angina without MI were assumed to be non-fatal, and cases of incident out-of-hospital ischaemic cardiac arrest (with or without MI) were assumed to be universally fatal. Inhospital case-fatality was obtained from an Argentine national hospital survey[12] and the Ministry of Health admissions database.[10] Overall MI case-fatality (including both out-of-hospital ischaemic cardiac arrest and inhospital CHD deaths) was estimated using the Policy Model after first entering incident CHD, hospitalised MI case-fatality, and overall death rates for CHD and non-CHD. Stroke inhospital case-fatality was obtained from an Argentine national registry[13] and administrative data. MI and stroke prevalence were obtained from a population-based risk factor telephone survey in Buenos Aires, done by the Ministry of Health.[14]

Non-cardiovascular mortality—Non-cardiovascular mortality was obtained from national vital statistics[10] for the same period. Attributable mortality due to tobacco was

included in the model using attributable fractions for different causes, combining tobacco use prevalence and relative risks, whenever possible using local risk estimates, but mostly relative risks were provided by the Cancer Prevention Study II.[15]

Tobacco use and other cardiovascular risk factors—Age and sex-specific prevalence for smoking and exposure to secondhand smoke (SHS), as well as BMI were obtained from the 2009 Second National Risk Factor Survey (*Encuesta Nacional de Factores de Riesgo*)[16] using a tobacco questionnaire adapted from World Health Organisation and Pan American Health Organisation instruments and validated for Argentina.[17] Means of SBP, LDL cholesterol and HDL cholesterol were obtained from Argentina's sample of participants in the Cardiovascular Risk Factor Multiple Evaluation in Latin America Study, a stratified random sample of men and women aged 25–64 years in the city of Buenos Aires during 2004–2005.[18]

Cardiovascular disease event prediction—For the main simulations, multivariate risk equations were estimated from US Framingham Heart Study data[19] with CHD (including stable or unstable angina, non-fatal MI, fatal MI or arrest) or stroke events (ischaemic stroke, including transient ischaemic attack, plus haemorrhagic stroke)[20] as the outcome. Risk coefficients for age, sex, SBP, smoking status, LDL, HDL, diabetes and BMI were estimated in the CHD prediction model and age, sex, SBP, smoking status and diabetes in the total stroke model.[20] Statistically significant ($p<0.05$) age-by-risk-factor interactions were incorporated into age-specific risk factor coefficients. Risk factor beta coefficients were estimated from examinations 9 to 13, 24 and 25 from the original Framingham Heart Study cohort and 1–6 from the Framingham offspring cohort, including participants for whom adequate data were available for a time-dependent logistic regression analysis. In order to model competing mortality risk, a separate non-CHD death equation was also estimated from Framingham data including age, sex, SBP, diabetes and smoking status.

Attributable risk analysis—Annual risk for CHD is calculated for each model cell by a multivariate logistic regression equation. Therefore the annual risk for events is determined by the age, sex and risk factor relative levels assigned to that cell, and the combined multiplicative effect of the risk factor coefficients. The overall proportion of CHD events explained by the selected major risk factors was obtained by simultaneously setting all of the risk factors to the minimum risk exposure level for the entirety of the 10-year simulation and comparing with a base case in which risk factor levels stayed constant at year 2010 levels. The resulting attributable proportions reflect a hypothetical scenario in which all risk factor exposures are removed at the same time, rather than removing the effect of single risk factors once at a time. Table 1 summarises data sources and a more detailed model structure, inputs and methodology could be found in the online appendix.

Effectiveness of the tobacco control interventions

We performed a literature review to obtain estimates of the effect of each individual component of the law at reducing tobacco use. We searched Medline, Embase, The Cochrane database of Systematic Reviews and The Community Guide website (http://www.thecommunityguide.org) for size effect estimates on cigarette consumption and not

cessation rates. This is because the CHD Policy Model simulates interventions on smoking through a relative reduction in mean number of cigarettes smoked per day in each sex, age and risk factor strata. We also contacted tobacco control experts for additional bibliographic recommendations. To assess the impact of the national law, the three components of smoke-free environments, pictorial health warnings and advertisement ban were considered multiplicative and their effects were considered independent (table 2). An intervention to increase cigarette prices was added to the model to assess the impact of an additional component to the law, also with a multiplicative effect approach. The effects of the interventions were considered annually, assuming the same effectiveness each year.

Comprehensive advertising, promotion and sponsorship ban—Several studies have shown that a complete ban on advertising can reduce tobacco consumption[24] and prevent relapse,[25] but usually estimated the effect of ban as a component of other effective tobacco control measures, such as smoke-free environments. [26] The national law included a comprehensive ban on advertising, promotion and sponsorship, but excludes point of sale restrictions on advertising. Although not a truly comprehensive ban, it implies a much stronger ban that the current national and local regulations. We assumed a 0.6% reduction in cigarette consumption per year if this level of advertising ban was implemented.[21]

FCTC compliant tobacco products health warnings—Although there is not a clear association between health warnings in tobacco products and cigarette smoking prevalence, strong and pictorial health warnings, adequately sized and located are better recalled and noticed, and are more effective at inducing smoking cessation and preventing smoking initiation in youth.[27] The Argentinean law required FCTC compliant health warnings on tobacco products, including pictorial health warnings, strong text messages and images covering at least 50% of all displayed areas, with frequent rotation. We estimated a 9% annual reduction in cigarette consumption if this intervention component was implemented.[22]

Nationwide 100% smoke-free environment without exceptions—There is consistent evidence that 100% smoking bans reduce exposure to SHS in workplaces, restaurants, bars and public places. The relative reduction in exposure is nearly 60% in most places after several years of implementation of the laws.[23] The available data indicates that smoking prevalence may not be reduced by smoke-free environments,[23] although in some studies consumption was reduced among workers.[28] Therefore, we considered for the CHD Policy Model simulation that this component of the law would result in a 60% relative reduction in SHS exposure, without impact on smoking prevalence or cigarette consumption.

Price increase—Although in Argentina the specific cigarette excise tax contributes to 60–70% of the cigarette price (ad valorem tax), the price of a pack of cigarettes is one of the lowest in Latin America, and sustains it as an affordable product.[29] It is known that an increase in the price of cigarettes may lead to a reduction in consumption and has been suggested as one of the most important measures for tobacco control.[2] However, the effectiveness of this intervention has to be adjusted for local elasticity (relationship between

price and demand). We estimated a 100% final price increase for the model simulation. We modelled an increase in final price since the current low price of a package in Argentina reduces the impact of the ad valorem tax increase, resulting in a non-significant final price increase. Analysing local econometric data, incorporating cigarette consumption elasticity, we considered for the model that a 100% price increase would reduce cigarette consumption by 31% (E Martinez, R Mejia, E Perez-Stable. Elasticity of cigarette demand in Argentina: an empirical analysis using vector error-correction model. Unpublished work. Personal communication).

Sensitivity analysis

Since the effects of the new law cannot be precisely known in advance, we conducted sensitivity analyses considering 'low effect' and 'high effect' scenarios. For the low effect scenario, we modelled a scenario with less than full compliance of the law and a smaller price increase. A study conducted by the Ministry of Health evaluated smoke-free law's compliance in cities with local 100% smoke-free laws and reported 21% non-compliance. [30] Based on that data, we assumed a reduction in 21% of 100% smoke-free environment size effect for modelling the low effect scenario. Other econometric studies about cigarette consumption elasticity in Argentina evaluated the impact of increasing the specific cigarette excise tax and suggested that an increase of 50% of this ad valorem tax (that may represent approximately a 30% final price increase) would reduce cigarette consumption by 12%.[31] For the 'low effects' scenario of the 'law plus price increase' we modelled that an increase of 50% in the ad valorem tax would reduce cigarette consumption by 12%. The advertising ban and warning labels size effects remained unchanged due to the scarce evidence that linked these variables and consumption.

We also modelled a 'high effect' scenario considering the effects that 100% smoke-free environments could have on active cigarette smoking. Although evidence is not conclusive about this effect,[23] we modelled that implementing 100% smoke-free environments would have an additional impact producing a 4.6% relative reduction in the number of cigarettes smoked.[32] The other size effect inputs (on advertising bans and warning labels and also on the effect of price increase) remained unchanged from the original model.

Finally, in order to take into account the uncertainty in the model's parameters, we ran Monte Carlo simulations with 1000 iterations, drawing from distributions for each of the risk function beta coefficients. The results of these simulations were used to determine CIs for the projected benefits of each modelled scenario.

RESULTS

Model calibration

The CHD Policy Model-Argentina predicted number of deaths was compared with actual CHD deaths observed from Argentina vital statistics for the years 1997–2009. We calculated from our national statistics database total CHD deaths in ages 35–84 years, that included definite CHD deaths (codes I20–I25) plus a percentage of poorly defined deaths (named 'garbage' codes) that could be attributed to CHD deaths (I461, I469, I472, I490, I460, I500,

I501, I509, I514, I515, I516, I519, I709).[33] We found a difference of less than 5% between the last total CHD deaths available from national statistics (24 246 for year 2009), compared with the first estimation of total CHD deaths from the CHD Policy Model (24 640 for year 2010) (figure 1A). Regarding stroke deaths, the difference observed was less than 10% (figure 1B). Moreover, the trend in projected CHD deaths (2010–2020) is similar to the trend in previous years. Poorly defined coded CHD deaths recorded by Argentina vital statistics remained a constant proportion of total deaths, suggesting that coding practices remained unchanged over that interval. Similar bias does not affect stroke mortality statistics, so stroke death rates were not adjusted.

Projected impact

The implementation of the current national law would avoid 7500 CHD deaths, 16 900 MIs and 4300 strokes through 2020 (table 3). These avoided events would represent a reduction of 3%, 3% and 1% in CHD deaths, MIs and strokes, respectively, as compared to continuing current baseline. If the price increase was added to the intervention components of the national law, the number of avoided events would potentially increase to: 15 500CHD deaths, 34 600 MIs and 11 900 strokes saved (what would represent a decrease in 8%, 7% and 6% in CHD deaths, MIs and strokes, respectively) (figure 2). It is important to note that the benefits of reducing tobacco use and exposure are observed in a short time period and by 2016 4200 CHD deaths, 9000 MIs and 2500 strokes would be avoided if the law was implemented and 8900 CHD deaths, 19 500 MIs and 6700 strokes if the price increase was added to the law.

Although it was not the aim of the study, the implementation of this law would also have benefits in non-CHD mortality due to the reduction of lung cancer for example. It is projected that 8600 non-CHD deaths could be avoided with the law and 24 800 if a price increase was included.

Sex and age differences in estimated benefit

The CHD deaths prevented with the implementation of the national law would occur mostly in men since men are the gender that suffers more CHD deaths (149 900, 64% of all deaths). This benefit would also be more evident in men if the law included the price increase (143 400, 63% of all deaths). In both cases, the tobacco control interventions would have more impact among the younger age groups (35–54 years) for CHD deaths included in the policy model (figure 3A). The MIs avoided would also occur mainly among men and those between 35–64 years if the national law was implemented, and similarly, if a cigarette price increase was added to the law since men are more likely to develop MIs (322 200, 64% and 377 800, 64% of all MIs respectively; figure 3B). On the other hand, the impact of these interventions on stroke prevention would be greater among women who would have a majority of avoided strokes (307 700, 53% of all strokes) if the law was implemented. If the cigarette price was increased, there were similar findings in stroke prevention that benefit more women than men (280 000 strokes, women with 54%). Similar to the previous analysis of avoided CHD events and MIs, the youngest groups from 35 to 64 years would benefit the most from implementation of the law (figure 3C).

Sensitivity analysis

The sensitivity analysis shows that the benefits would be even high in the 'low effect' scenario since the implementation of the Argentinean Tobacco Law could avoid 6800 CHD deaths, 15 400 MIs and 4000 strokes. In addition, if the price increase was added to this 'low effect' scenario the CHD deaths, MIs and strokes saved could be 7900, 17 700 and 4900 respectively (table 4).

Moreover, in the setting of a 'high effect' scenario the additional impact would be considerable, avoiding 9100 CHD deaths, 20 500 MIs and 5500 strokes with the law and 16 000 CHD deaths, 35 600 MIs and 12 500 stroke if the price increase was included (table 4).

DISCUSSION

The impact of the implementation of the national tobacco control law on the health of the public in Argentina would be dramatic in terms of avoided CHD deaths, MIs and strokes. These results should provide persuasive evidence to convince the Executive Branch to authorise full implementation of the law before more unnecessary deaths occur in the population. In addition, if this law could be improved with a mandate to increase the price of cigarettes, the number of avoided heart attacks and strokes and saved lives would be even higher. Men have both higher CHD risk[34] and higher smoking prevalence compared with women, and, as a consequence men would benefit more from increased tobacco control in terms of avoided CHD deaths and MIs. The middle-aged population represents the targeted segment for many tobacco control programs[1] and it is precisely in this group for whom interventions would be the most cost effective, even though the target population of these tobacco control measures includes everyone.

These results reflect the expected effectiveness of the measures included in the national law, such as implementation of smoke-free environments, advertising, promotion and sponsorship ban and pictorial warnings in cigarette packages, and assuming a full implementation and enforcement. Even in the 'low effect' scenario that considered a weak enforcement the impact would be really high. There is strong evidence that a tobacco control initiative like this will reduce deaths from CHD over a few years.[28] We also modelled the incremental effect of a significant price increase even though it is not currently included in the national tobacco control law.[35] Additionally, if the price increase was limited, as modelled in the 'low effect' scenario, the impact of such measure is still considerable. Given that a price increase is known to be the most effective measure to reduce tobacco consumption, cigarette price increase needs to be discussed as part of Argentina's public health agenda.

Some modelling experiences regarding tobacco control have been developed in the region. Ferrante *et al* modelled the effect of tobacco control policies in smoking prevalence and associated future premature mortality using the SimSmoke[36] but projecting the effect of a generic package of tobacco control laws.[37] The availability of new epidemiological and demographic data, improved non-communicable diseases surveillance methods and the recent sanction of a national tobacco control law enhances the value and timeliness of the current modelling. Moreover, to our knowledge this is the first time that the potential benefit

of a concrete law is modelled for a Latin American country and in addition the first time the CHD Policy Model is used for this purpose.

National tobacco control laws have been successfully implemented in several countries of Latin America. In 2006 Uruguay became the first Latin American country to adopt a comprehensive 100% smoke-free tobacco control law that achieved a dramatic reduction in smoking prevalence[29] and in cardiovascular morbidity. [38] These analyses based on the CHD Policy model are likely to be applicable to other Latin American countries and can be used to advocate robust tobacco control legislation in the region.

Although legislation is considered one of the most powerful resources for improving health of populations,[39] some threats may undermine its impact. Wong *et al*[40] identified lobby group opposition as a threat to legislative intervention but suggested the need to be assessed the feasibility of tobacco industry lobbying in each case. There is evidence of tobacco interferences through lobbying not only in Latin America[41] but also in Argentina, for example, impeding the ratification of the FCTC.[42] Authorities should be alerted about these tactics and must be convinced of the huge impact on public health the implementation of this law will have to be able to succeed.

We identified several limitations in this study. Uncertainty regarding the external validity of some intervention effect size data collected from other jurisdictions could represent a threat to the accuracy of the findings. It is difficult to estimate the isolated effect of each intervention, since the available evidence often comes from pre–post studies that implement several interventions at the same time. In addition, although we incorporated all the available local and regional data to the model, some of them could not be representative of the national level. Lastly, although the CHD Policy Model was developed in a population that could suffer cardiovascular events with a different set of associations and weights between risk factors and outcomes, compared with a Latin American population,[43] the model has been calibrated to Argentina and evidence suggest that the effect of risk factors on cardiovascular disease outcomes are essentially universal.[44]

In order to improve the accuracy of these findings, disease morbidity registries need to be developed and sustained at a national level so that population based data increases generalisability. The availability of comprehensive information of the Global Adult Tobacco Survey, now being implemented in Argentina, could also help to contextualise the impact that the implementation of this law may have.

We believe that the impact of this law, especially if price increases are included, would be very significant in Argentina. We consider that these results may also be extended to other Latin American countries that may not be considering robust tobacco control laws, with demonstrated health benefits, due to tobacco industry influence. This analysis should urge authorities to authorise and fully implement the national tobacco control law since it is an initiative that would save thousands of lives and would reduce the incidence of major cardiovascular events. Although a cost-effective analysis was not developed it is probable that this constitutes a cost saving intervention for Argentina.[37] The simulation of a scenario of cigarette price increase reflects the importance of including such interventions into a more

comprehensive tobacco control law. Our results provide evidence-based support for advocates to convince government authorities and for authorities themselves to face tobacco industry lobby that could help to authorise and fully implement the current legislation and to eventually improve the national tobacco control law through a price increase. The development of this type of report may represent an invaluable component in support of Argentina's tobacco control movement.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What this paper adds

- Although legislation is considered one of the most powerful resources for improving health of populations, particularly for tobacco control, some threats (tobacco industry lobbying for eg) may undermine its impact.
- This paper reflects the effectiveness of the Argentinean tobacco control law in terms of cardiovascular disease and provides evidence-based support for government and advocates fighting for full implementation of the current legislation.

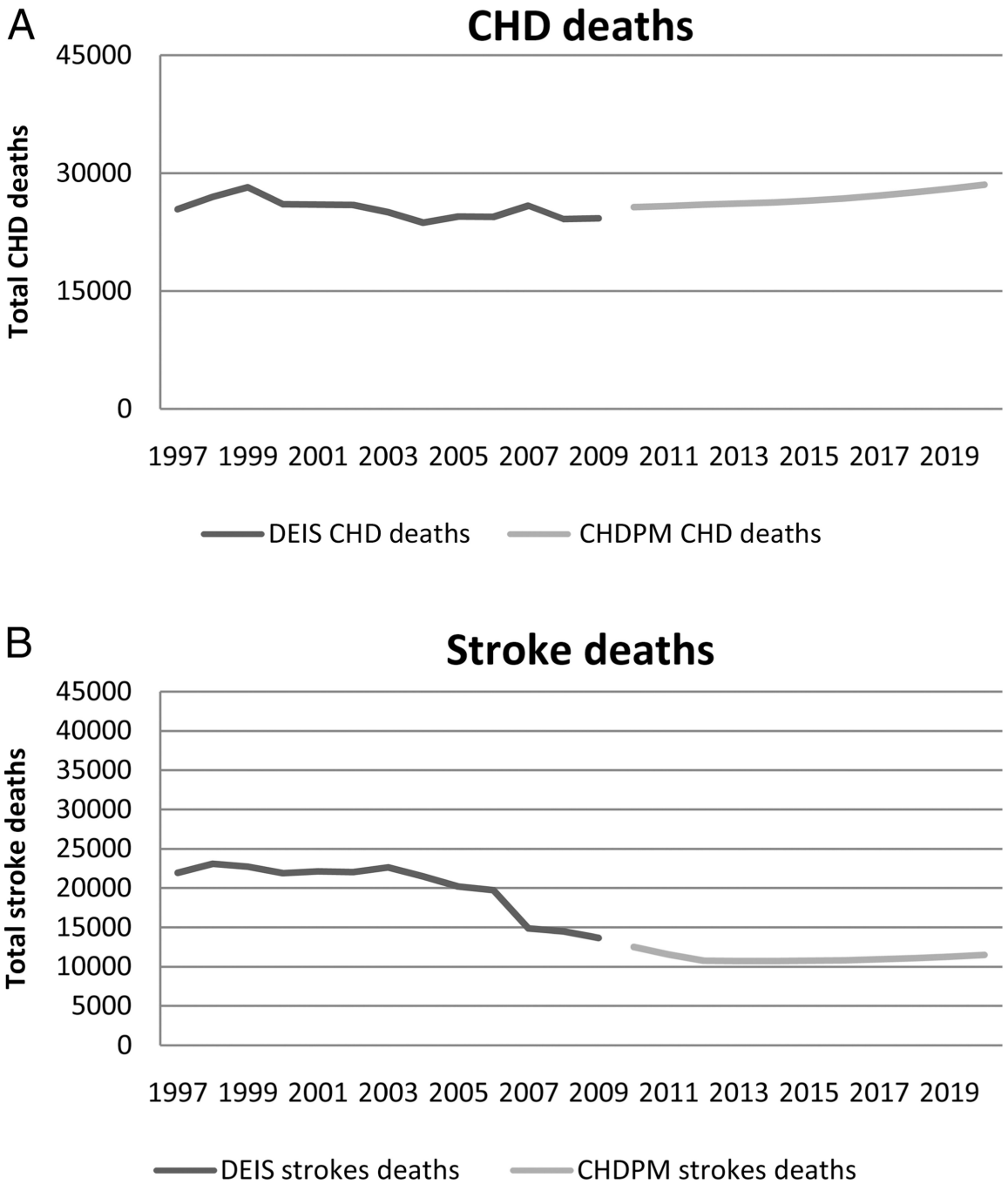

Figure 1.
Coronary heart disease (CHD) deaths (A) and stroke deaths (B) from vital statistics (Dirección de Estadística e Información en Salud, Ministerio de Salud de la Nación, DEIS) and projected by CHD Policy Model-Argentina (CHDPM).

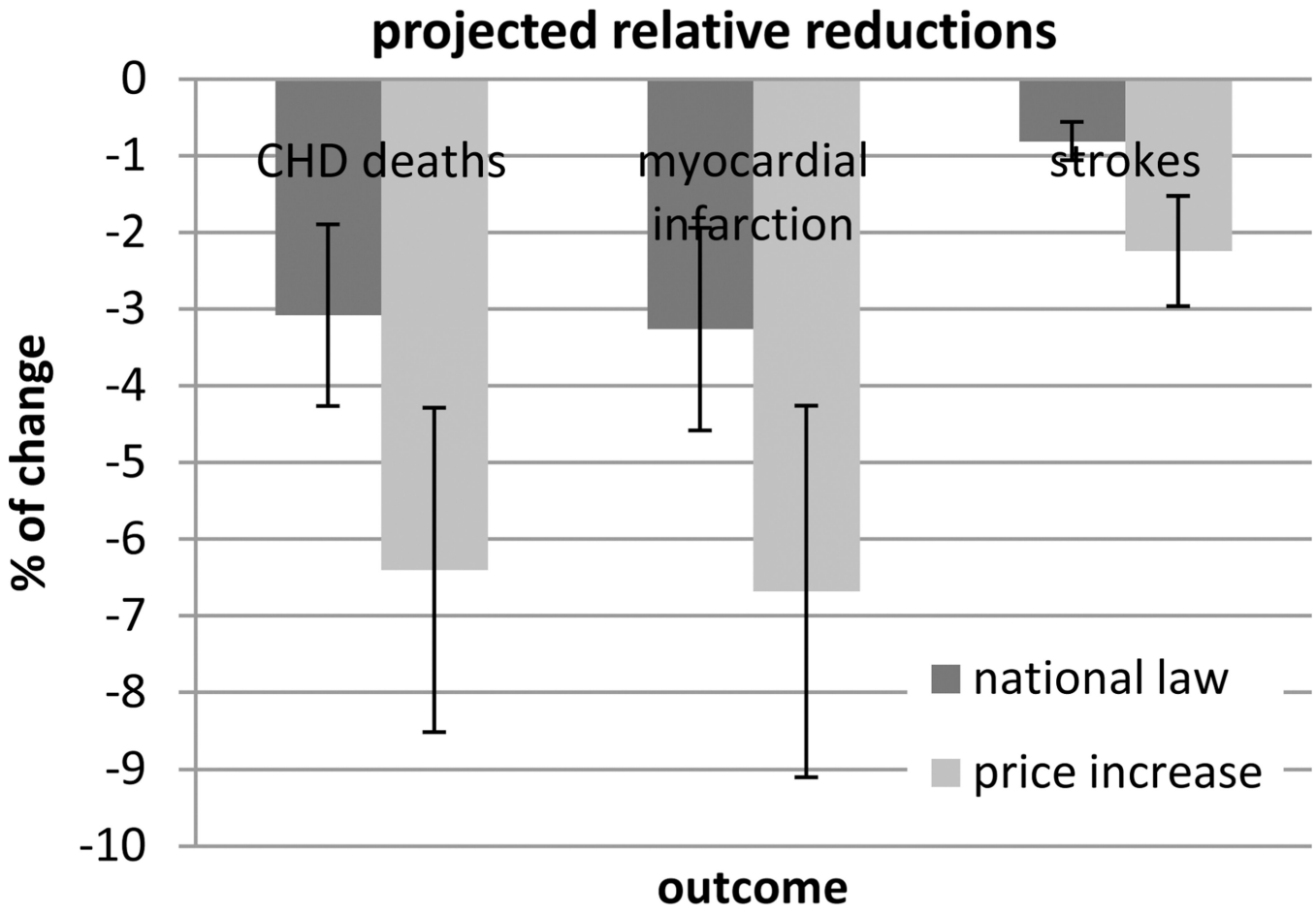

Figure 2.

Projected relative reductions in coronary heart disease (CHD) deaths, myocardial infarctions and stroke if the national law was implemented and if price increase was included in the law compared with the basal scenario.

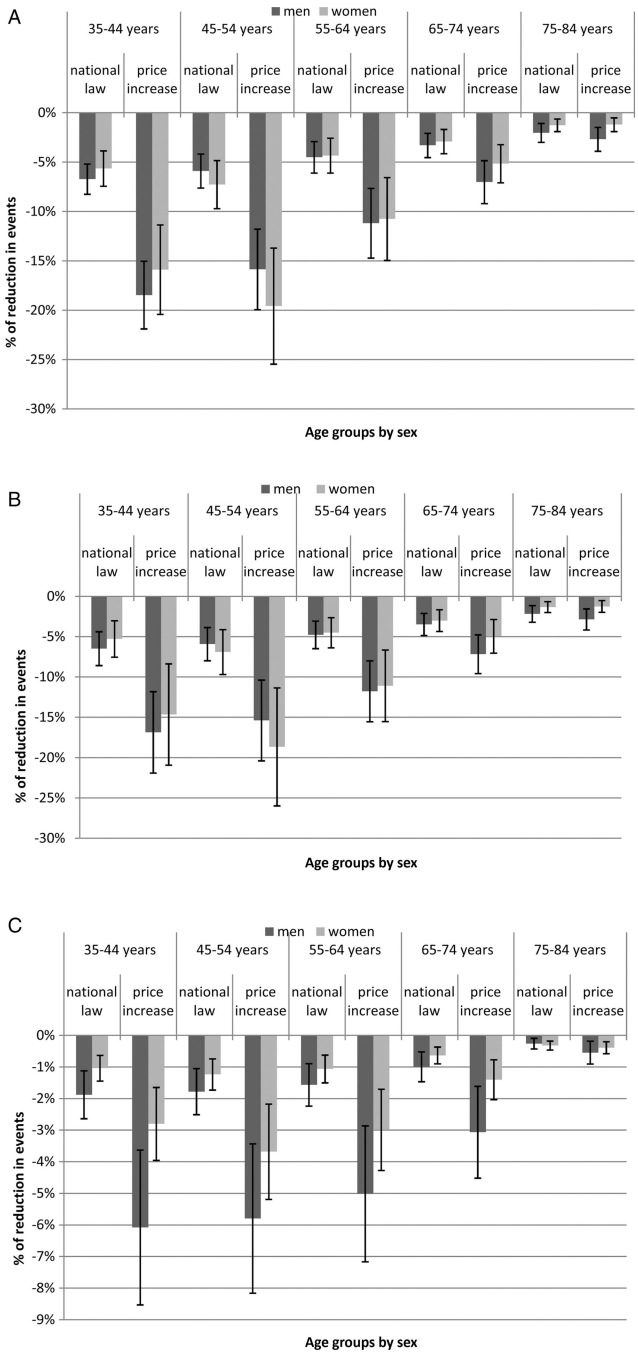

Figure 3.

Absolute reductions in coronary heart disease deaths (A), myocardial infarctions (B) and strokes (C) if the national law was implemented and if price increase was included in the law, compared with the existing baseline scenario, by sex and age groups.

Table 1

Model inputs for the CHD Policy Model Argentina

Variable	Source
Population of Argentina and incoming 35-year-old persons, 2010–2050	2010 Census; http://www.indec.gov.ar
Incidence	
CHD	Incidence of hospitalised AMI: Caccavo *et al*, 2007
Total stroke	Incidence of stroke: national vital statistics and hospital admission registry, Ministry of Health, Argentina
Prevalence of CHD in 2010	Pilot test for the non-communicable diseases telephone surveillance system, Ministry of Health
Total and cause-specific mortality	
Total	National vital statistics, http://www.indec.gov.ar, all deaths in adults age 35–84 years
CHD	1997–2009 vital statistics; using CHD ICD-10 codes I20–25 and 2000 Global Burden of Disease 'garbage code' definitions for a proportion of CHD deaths (see text)
Stroke	1997–2009 vital statistics; using stroke ICD-10 codes I60–69
CHD risk factor means and joint distributions, 2010	Cardiovascular Risk Factor Multiple Evaluation in Latin America (CARMELA) Study and *Segunda Encuesta Nacional de Factores de Riesgo* (Second Argentine National Risk Factor Survey)
Risk factor hazards for CHD and stroke	Framingham Heart Study (USA)
One-day and 28-day CHD case-fatality	
CHD	Blanco P *et al* Encuesta de SAC, 2007
In-hospital	
Stroke	
In-hospital	Argentinian National Stroke Registry (ReNACer)
28-day case fatality	Proyecto investigacion de Stroke en Chile: Iquique Stroke Study (PISCIS)

CHD, coronary heart disease

Table 2

Estimated changes in cigarette consumption and exposure to Second Hand Smoke (SHS) with the implementation of the tobacco control law approved by Argentina's Congress and the additional effect of a cigarette price increase

Intervention	Description	Estimated effect size*	Reference
National tobacco control law	Advertising, promotion and sponsorship ban	Decrease in cigarette consumption of 0.6%	[21]
	Health warnings	Decrease in cigarette consumption of 9%	[22]
	100% smoke-free environments	Decrease in exposure to SHS of 60%	[23]
National law plus a price increase	100% of price increase	Decrease in cigarette consumption of 31%	Martinez E, Mejia R, Perez-Stable E. Elasticity of cigarette demand in Argentina: an empirical analysis using vector error-correction model. Unpublished work. Personal communication

* The size effects are expressed as relative reductions.

Table 3

Projected and saved events from 2012–2020 in different scenarios

	CHD deaths	Myocardial infarction	Strokes
Events			
Baseline			
Men	155100 (152000–159000)	334400 (324000–344000)	248100 (247000–249000)
Women	87300 (86000–89000)	182700 (179000–186000)	281700 (280000–284000)
Total	242400 (238000–247000)	517100 (503000–531000)	529800 (527000–532000)
Events avoided			
Tobacco law			
Men	5300 (3300–7200)	12100 (7400–17000)	2500 (1400–3600)
Women	2200 (1300–3100)	4800 (2600–6900)	1800 (1000–2500)
Total	7500 (4600–10300)	16900 (10000–23700)	4300 (3000–5600)
Law plus price increase			
Men	11400 (7800–15000)	26000 (17100–34800)	7700 (4300–11200)
Women	4100 (2600–5700)	8600 (4900–12300)	4200 (2300–6000)
Total	15500 (10400–20700)	34600 (22000–47100)	11900 (8100–15700)

CHD, coronary heart disease.

Table 4

Projected and saved events in the low and high effects scenarios from 2012–2020

	CHD deaths		Myocardial infarction		Strokes	
Scenario	**Low effects**	**High effects**	**Low effects**	**High effects**	**Low effects**	**High effects**
Events						
Baseline						
Men	155.100 (152000–159000)	155.100 (152000–159000)	334.400 (324000–344000)	334.400 (324000–344000)	248.100 (247000–249000)	248.100 (247000–249000)
Women	87.300 (86000–89000)	87.300 (86000–89000)	182.700 (179000–186000)	182.700 (179000–186000)	281.700 (280000–284000)	281.700 (280000–284000)
Total	242.400 (238000–247000)	242.400 (238000–247000)	517.100 (503000–531000)	517.100 (503000–531000)	529.800 (527000–532000)	529.800 (527000–532000)
Events avoided						
Tobacco law						
Men	4.800 (3100–6600)	6.500 (4200–8700)	11.100 (6800–15400)	14.800 (9400–20100)	2.400 (1300–3500)	3.300 (13800–4700)
Women	2.000 (1100–2800)	2.600 (1600–3700)	4.300 (2300–6200)	5.700 (3300–8100)	1.600 (900–2300)	2.200 (1200–3100)
Total	6.800 (4200–9400)	9.100 (5800–12400)	15.400 (92000–21600)	20.500 (127000–28300)	4.000 (2700–5400)	5.500 (3700–7200)
Law plus price increase						
Men	5.700 (3700–7700)	11.800 (8200–15500)	12.900 (8100–17700)	26.800 (17800–35900)	3.000 (1600–4400)	8.100 (4600–11600)
Women	2.200 (1300–3200)	4.200 (2600–5800)	4.800 (2600–6900)	8.800 (5000–12600)	1.900 (1100–2700)	4.400 (2400–6400)
Total	7.900 (5000–10800)	16.000 (10800–21300)	17.700 (10700–24700)	35.600 (22800–48500)	4.900 (3200–6600)	12.500 8500–16500)

CHD, coronary heart disease.