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Original Research

Impact of a comprehensive law on the prevalence of tobacco consumption in Spain: evaluation of different scenarios



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ABSTRACT

Objectives: Since 2011, smoking legislation was hardened in Spain, banning tobacco consumption in all hospitality venues. Law 42/2010 was the first comprehensive tobacco control policy enacted in Spain. The aim of this paper is to evaluate the effect that this intervention has had in reducing the prevalence of tobacco consumption, setting up three scenarios on the basis of different theoretical levels of effect of the law.

Methods: A predictive model based on Markov Chains was developed to distinguish the effect of tobacco control policies in different scenarios.

Study design: The model developed uses population, smoking rates and smoking characteristics from a non-transmissible disease surveillance system developed in Galicia (namely SICRI).

Results: Results show that tobacco control policies hardly affect the predicted trend in a temporal frame of 10 years, with relative reduction in the predicted male smoking prevalence of 20.4% with no intervention, reaching a reduction of 26.1% under the maximum effect of the policies.

Conclusions: In the global population the effects of the law in the predicted prevalence have been barely perceived. For people under 25 years of age, interventions have had an important and positive effect, which proves that policies affecting this age group should be hardened.

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Introduction

Nowadays, tobacco consumption is one of the most serious threats to human health, both in developed and underdeveloped countries. The latest Surgeon General's Report¹ established an increase in the number of tobacco-related causes of death to over 20 and it is suspected that tobacco is involved with other causes of mortality.

Although recognized as an important risk factor for health, the burden of disease associated with tobacco consumption continues at high levels worldwide, despite the fact that smoking prevalence is decreasing in developed countries. In Spain, smoking prevalence has decreased from 1987 to 2011,² but mortality attributable to tobacco consumption remains a leading cause of death.³

Legislative measures against this risk factor have been implemented in Spain through the approval of two laws in the last seven years. The first law 28/2005⁴ was a partial ban considering the preservation of smoking areas on public premises. Evaluation of the impact of the law has confirmed its success in decreasing second-hand smoke exposure,^{5,6} although significant impact on tobacco consumption prevalence has not been shown.² This law was modified and a comprehensive regulation was introduced in 2011, namely law 42/2010.⁷ Law 42/ 2010 expanded legislation enacted in 2005, especially in regards to those issues related to smoke-free areas. Therefore, since 2 January 2011, smoking was banned in all hospitality venues without exception and the Law was considered the first comprehensive tobacco control policy enacted in Spain.

The objectives of this study are to assess the evolution of smoking prevalence in a Spanish area (Galicia) during the period 2010–2020 by applying a Markov model, as well as to assess the impact of the law 42/2010 on these figures by setting up three scenarios on the basis of different theoretical levels of enforcement of the law 42/2010.

Methods

Setting

Galicia is a region located in northwest Spain, bordered by Portugal to the south and the Atlantic Ocean to the west and north. The population is largely concentrated in the coastal areas and the climate is temperate and rainy. It had a population of 2,765,940 inhabitants in 2013 and has a total area of 29,574 km², while Spain had more than 47 million inhabitants and a total area of 504,645 km².

Predictive model

A predictive model aimed at establishing population behaviour related to tobacco consumption is proposed. The model is based on a discrete-time Markov Chain,⁸ and includes demographic information regarding births and deaths. It also follows some parts of SimSmoke procedure.⁹

The Markov Chain model is characterized by defining a state space, a transition matrix and a probability vector with an initial distribution on the possible states. In our setting, a space of thirteen states, based on both status of tobacco consumption and age group has been specified. The space of states is given by: (NS1, NS2, NS3, NS4, S1, S2, S3, S4, FS2, FS3, LFS2, LFS3, FS4),where the number denotes the age group (1: 16–24, 2: 25–44, 3: 45–64, 4: 65 years and over), and NS, S, FS, LFS denote the status of tobacco consumption: never smokers, smokers, former smokers and long-life former smokers, respectively. The possible transitions between these states are shown in Fig. 1.

The elements in the transition matrix are the transition probabilities between the states of the chain in a stage given by one year.

In order to compute the transition matrix as well as the initial distribution of the chain, a sample of the Galician population was used. The current state of an individual and the state in the previous year were derived with the following SimSmoke assumptions:

- For being a smoker an individual must start smoking before 25 years old. From this age on no additional initiation takes place and a never smoker will keep this status until death.
- Former smoker status does not exist until older than 25 years old.
- A long-life former smoker is an individual that gave up smoking for one year or more. A long-life former smoker will keep this status until death.
- A smoker in the 65 years and over age group that gave up smoking, independently of how long they gave it up, will keep this status until death.

The probabilities involved in the Markov Chain characterization were estimated by Maximum Likelihood,¹⁰ taking into account the sample design of the survey, with the observation of current and previous state in a certain year for each individual in the sample.

From an initial year, the predictive model defines a formula to predict next-year number of individuals in each state as in the SimSmoke model. These formulae use both the transition probabilities and demographic information.

Birth information is introduced for each predictable year. Because the first age group starts at 16 years, only the population of this age is considered (obtained from the population of 15 years in the previous step). Mortality rates by age group and tobacco consumption status are also included.

In order to assess the effects of restrictive policies on tobacco consumption, the transition probabilities of the model must be modified. For each policy, the estimated percentage of change (PC) is applied to the transition probabilities (Prob) as follows:

Prob (starts smoking in the 16–24 age group) \times (1 – PC)

Prob (quits smoking in the 25 and over age groups) \times (1 + PC)

The model can be adapted in order to consider more than one policy by including multiplicative effects. In order to keep the properties of the transition matrix, where rows must add up to exactly one, all the changes in its values are offset by the remaining values in the same row. Download English Version:

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