

Application of SimSmoke to other Nations by David Levy

The SimSmoke tobacco control simulation model projects smoking rates and deaths attributable to smoking (in total and for lung cancer, COPD, heart, and stroke), and examines the effect of tobacco control policies on those outcomes. The model can be used to examine the effect of policies individually and in combination on different ages and other demographic groups. The model can be used for predictive/planning purposes, justification of policies individually or as part of a comprehensive tobacco control program, and to help facilitate understanding of the role of tobacco control policies and how they may be most effectively implemented.

SimSmoke is developed in 3 parts:

- 1) The Population Module in which the population evolves through births and deaths,
- 2) The Smoking Module which distinguishes smokers, never smokers and 6 categories of ex-smokers and these numbers evolve based on initiation and cessation rates, and death rates of smokers and ex-smokers relative to never smokers, and
- 3) Individual Policy Modules (taxes, clean air laws, media campaigns, cessation treatment programs and youth access enforcement) which translates the effect of policies implemented in different ways on smoking rates.

Currently, the model distinguishes the population by age, gender and racial ethnic groups represented (White, African American, Hispanic, Asian and other), and predicts smoking rates and deaths for each of the demographic groups. The age, gender and especially racial/ethnic groups in the model can be adjusted as relevant to the important socio-demographic demographic differences and data availability of other nations.

The current SimSmoke model uses the year 1993 as a baseline and tracks smoking rates between 1993 and 2000 based on previous trends and the effects of policies implemented between 1993 and 2000. After the year 2000, the user chooses the level of policies and the model shows the effect relative to the business as usual scenario (with policies maintained at their 2000 level). In developing the model for a nation, the model could be developed to project from the current year forward or (as in the current SimSmoke model) could track policies over some prior time period. In the latter case, the model can be used to gauge the effect of the policies over the time period and see how well the model predicts for that period. For example, the model may be programmed to examine the effects of policies since a proactive tobacco control policy began, and then used to show the effect of policies over that time period. Tracking over some prior time period may also be used to calibrate/validate the model.

Below is a table with minimal needs to develop a national model, and needs for a more extensive model (“wish list”). The minimal model just predicts from the current year forward. The more extensive model includes more detailed demographic breakdowns, more refined information on relative risks, initiation and cessation rates, and tracks policies over a prior time period. Following the table is more extensive discussion of the uses of simulation models generally and

of SimSmoke in particular.

Data Requirements for SimSmoke

Variable	Minimal needs	“Wish list”
I. Population model		
A. Current population	Recent year population of country with breakdowns by age* and gender	Finer breakdowns by age (especially under the age of 25). Breakdowns by SES, racial/ethnic, immigrant, or regional differences (urban/rural) if relevant.**
B. Fertility rates	By age* groups	Breakdowns by age, and by other socio-demographic variables if relevant
C. Mortality rates	Overall death rates by age and gender groups used above or reasonable approximation (can apply averages over broader age groups to younger age groups)	Any additional socio-demographic breakdowns as suggested above. In addition to all deaths, by lung cancer, COPD, heart and stroke
D. Immigration rates	Overall annual rate as a percent of current population (in net terms) if a large percentage of population growth	Rates by socio-demographic group if immigration is an important part of population growth.
II. Smoking model		
A. Baseline smoking rates for current smokers and ex-smokers	Number of current smokers (at least 100+ cigarettes lifetime) in the nation by the age and gender groups above. Some indication of the number of ex-smokers.	Any additional socio-demographic breakdowns as suggested above. Breakdowns of ex-smokers by age and gender, and number of years since quitting (<1, 1-2, 3-5, 6-10, 11-14, 15+ years).
B. Initiation rates	Inferred from current smoking rates of those ages 10-29.	Specific information on initiation by socio-demographic groups. May account for trends as income of the nation increases
C. First yr. cessation	Population indicator of annual cessation rates	Specific information on initiation by socio-demographic groups. See also cessation module below.
D. Relapse rates	None	Measures of rates corresponding to ex-smoker groups above.
E. Relative death risks of smokers and ex-smokers to never smokers	None	Measures of relative risk by age and gender specific to The nation, and by type of death if relevant.
III. Policy Modules		
A. Taxes	Prices and taxes for baseline year and recent prior years	Prices and taxes over some prior period of interest*** Studies of tax effects and information on the role of cross border purchases or smuggling in The nation.
B. Clean air laws	Different types of laws currently in effect and their stringency	Information on laws over some prior period of interest. Extent of private policies (work site bans voluntarily implemented by firms). Studies of the effect of past laws for The nation.

C. Media and other educational campaigns	Current expenditures on media campaigns and date of initiation.	Information on campaigns over some prior period of interest, and whether they target specific audiences. Knowledge about media effectiveness in the nation. Extent of advertising bans on tobacco manufacturers.
D. Youth Access	Current policies in practice regarding age limitations, enforcement checks, penalties, community campaigns, self-service and vending machine bans	Information on policies over some prior period of interest, extent of use that is purchased and from other sources. Knowledge about ability to enforce laws in the nation.
E. Cessation Treatment	Current policies regarding coverage of physician/ health care provider interventions and coverage of treatments (Pharmacotherapy and behavioral)	Information on past policies over some prior period of interest. Treatment uses and effectiveness, current insurance coverage, effects of public policies on use. Knowledge about the level and characteristics of the health care system.

* The age groups need to be less broad at the earlier levels to account for initiation and fertility. A reasonable breakdown would be (0-9, 10-14, 15-19, 20-24, 25-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+).

** Other socio-demographic distinctions beyond age and gender may be considered because those groups are of political interest or they have different and identifiable smoking or other health (as suggested in different mortality patterns) habits. Data must be available to distinguish different smoking patterns if that is the important consideration.

*** The model is be used to examine the effect of policies over some prior time period, e.g., since a proactive tobacco control began. This serves to show the effect of policies over that time period, and will also be used to calibrate/validate the model.

The Uses of Simulation Models

Simulation models can be useful tools in informing policy makers who are trying to develop an appropriate mix of policies to reduce tobacco use and its consequences, and, more generally, in helping to understand the effects of tobacco policies. They can serve to predict future tobacco use and the effect of policies on that use, justify the implementation of particular policies, and help to better understand the impact of these policies.

Simulation models generally start with a *status-quo* scenario, which projects smoking rates and health outcomes from some date forward in the absence of any specific policy addressing tobacco use. This type of information enables policy makers to understand and plan for likely future trends. Status quo scenarios generally reflect current policies, which is generally the base most relevant to policy makers. The models predict the effect of new policies on current levels and trends in smoking rates. The level of socio-demographic detail may vary from model to model, but, at a minimum, variation in smoking levels across different age cohorts is needed.

Simulation models can allow policy makers to conduct experiments to determine the effects of well-defined programs and/or policies on smoking rates and specific tobacco-related problems in their communities before the actual expenditure of funds. Policies may be considered individually and then compared. For example, policy makers can use models as a tool to estimate the long-term impact of a tax increase on smoking rates or deaths, and to compare these effects to those of youth access policies. The effects of policies may be gauged in terms of the level and timing of their effect on smoking-related harms as well on smoking rates.

Different policies may be also considered together or implemented in some sequence. The effect of newly implemented policies in a state or community is likely to depend on the policies already in effect, as well as on the intensity of their implementation and enforcement, and on policies being considered. For example, mass media-related policies may be more effective if they are accompanied by attempts to pass clean air laws or raise taxes.

The effects of policies on different socio-demographic groups may also be considered. Many policies are likely to affect those of different ages, genders, racial/ethnic groups, or income/education levels in different ways. Consequently, knowledge of the effects of policies on these different groups will be helpful in targeting policies to particular populations where the need is greatest, and in coordinating the effects of different policies. For example, treatment-oriented policies aimed at adult smokers may be an important adjunct to youth-oriented policies, not only because they affect a different population but also because adults serve as a role model for youth and as a potential source of cigarettes.

The simulation model can be incorporate into a broader evaluation/surveillance system. The simulation model can be used to gauge the effect of the policies over some time period and see how well the model predicts for that period. For example, the model may be programmed to examine the effects of policies since a proactive tobacco control program began, and then used to show the effect of policies over that time period. Tracking over some prior time period may also be used to calibrate/validate the model. As independent empirical studies are conducted to evaluate the effects of policies, the results from those studies can be used to update the model.

The simulation model may also be used to determine whether the results of an evaluation are broadly consistent with past studies by comparing the results to predictions of the model.

The results of simulation models may be used to justify specific tobacco policies or tobacco policies in general. The effect of one tobacco control policy may be considered relative to another policy in order to determine which is more effective. Alternatively, tobacco control policies may be compared to other public health policies, such as treatment for alcohol abuse.

Part of justifying tobacco control policies is a “heuristic” role of explaining the effects of policies to those less familiar with the public health literature. Simulation models demonstrate what is known from the scientific literature concerning the relative effectiveness of various policy approaches on the prevention of smoking and its consequences. They provide a useful method for helping to understand the basic effects of policies.

Besides being used as a teaching device, simulation models may help to provide guidance on research needs in the field of public health and help define priorities and new directions for this research. In developing equations in simulation models, decisions must be made to explain how policies affect smoking outcomes. Policies may be transmitted through the population in various ways. They may affect the physical or financial availability of tobacco products, norms regarding use, or the ability to get successful treatment. They may affect initiation, quit or relapse rates, may have effects of different magnitude and duration, and may affect different socio-demographic groups in different ways. Policies may have interactive effects that make them more effective when implemented as a package. In other words, simulation models force the developers to think in a system wide fashion that provides a basis for a more complete understanding of the policies. In developing the linkages, the limitations of our knowledge on the effects of different policies are also made more explicit.

In addition to examining how policies affect the population, simulation models may be used to examine the form that policies may take. For example, youth access policies generally involve some combination of compliance checks, penalties on those who violate the law, and attempts to educate and mobilize the community. The model may consider how different uses of these components may affect outcomes of the policy. Thereby, models can help policy makers to more effectively implement policy. In addition, simulation models may provide a structure for those studying public health to better understand and explore the effects of a policy.