

Tobacco Endgame Simulation Modelling

Assessing the Impact of Policy Changes on Smoking Prevalence in 2035

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January 2019

Citation: Dubray J, Chaiton M, Schwartz R. *Tobacco Endgame Simulation Modelling: Assessing the Impact of Policy Changes on Smoking Prevalence in 2035*. Special Report. Toronto ON: Ontario Tobacco Research Unit; January 2019.

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Background

In October 2016, a Tobacco Endgame for Canada Summit was convened with over 80 experts, researchers, government officials, advocates, and health professionals in attendance to discuss possible interventions to reach the target goal "less than 5 by '35". In this report, we describe the findings from simulation models that assessed the impact in Ontario of five of the potential Tobacco Endgame interventions discussed at the Summit. They include:

- 1. Plain packaging for all tobacco products
- 2. Free cessation services for all (both pharmaceutical and behavioural therapy)
- 3. Decreasing the number of outlets selling tobacco products
- 4. Increasing tobacco taxes
- 5. Increasing the minimum age to legally purchase tobacco to 21 years

Methods

Four of the Tobacco Endgame interventions were modelled using the Ontario SimSmoke simulation model. The Ontario SimSmoke model is adapted from the SimSmoke simulation model of tobacco control policies, previously developed for the U.S. and other countries. The model uses population, smoking rates and tobacco control policy data for Ontario. It assesses, individually, and in combination, the effect of seven types of tobacco control policies (taxes, clean air, mass media, advertising bans, warning labels, cessation treatment, and youth access policies) on smoking prevalence and associated future premature mortality.¹ Although modelled for an Ontario population, the Ontario SimSmoke model is a reasonable proxy for all of Canada due to similar smoking prevalence (e.g., 16.7% in Canada vs. 16.1% in Ontario in 2014) and shared tobacco policies (e.g., Smokers' Helpline, warning labels, advertising bans, clear air policies).

Modifications were made to the Ontario SimSmoke policy levels or policy effect sizes to assess the impact of each Tobacco Endgame intervention on smoking prevalence in Ontario between 2019 and 2035. For plain packaging, the comprehensive marketing ban (both direct and indirect) policy level in Ontario SimSmoke was increased to 90% (up from 25%) as a proxy measure for plain packaging.

Free cessation services were modeled twice in Ontario SimSmoke. The first model incorporated free cessation services (pharmacotherapy and behavioural therapy) in all primary care and hospital settings, similar to the Ottawa Model for Smoking Cessation intervention. The second model expanded the number of settings offering free cessation to also include offices of health professionals, community and 'other.'

Analyses conducted by Chaiton, Mecredy and Cohen² identified an increased risk of relapse among smokers who resided within 500m from a tobacco outlet (Hazard ratio: 1.41) compared to those who lived further away. As a proxy measure for decreasing the number of outlets selling tobacco products, the policy effect sizes in Ontario SimSmoke for the five cessation treatment policies (treatment availability, treatment access, quitlines, quitlines with treatment access, and brief interventions) were increased by a value of 1.41. Price elasticities were doubled in the Ontario SimSmoke model to assess the impact of increased tobacco taxes on smoking prevalence. Specifically, the policy effects were increased to -0.6 for youth less than 18 years (when price is increased by 10%, demand for cigarettes reduced by 6%), -0.4 for young adults aged 18 to 24 (demand for cigarettes reduced by 4%), -0.3 for adults aged 25 to 34 years (demand for cigarettes reduced by 3%) and -0.2 for adults aged 35 years or more (demand for cigarettes reduced by 2%).

The final Tobacco Endgame strategy, increasing the minimum age of legal purchase to 21 years, was assessed in a separate simulation model (a modified version of the simulation model presented in the A Tobacco Endgame for Canada Summit Background paper³ for tax and price increases). In this model, we simulate the impact of minimum age laws by using a population program in which the baseline *status quo* rate of change in smoking prevalence was estimated to be 1.1% per year. We obtained smoking prevalence from 2014 CCHS. We used Statistics Canada medium growth population projection scenario (M1: medium-growth, 1991/1992 to 2010/2011 trend, CANSIM Table 052-0005). The number of people aged 20-22 was obtained from the Ontario Ministry of Finance for years 2018-2035. Based on the analyses conducted by Callaghan et al,⁴ it was assumed that the rate of onset for new smokers aged 20-22 would be 2.7 percentage points lower than it would have been under the standard projection for each year if the minimum age ban took effect immediately. No changes in prevalence were modelled for older ages at the time on the implied onset of the law; however, the effect was carried through as the cohort aged. Additionally, it was assumed that the increased age of onset would be associated with increased cessation in this cohort (natural rate of decrease adjusted from 0.011 to 0.022). No adjustment was made for any effects in youth younger than 19 whom might be affected by reduced access to tobacco. No adjustment was made for any additional social normative effects.

Results

Results from the Ontario SimSmoke simulation model indicate that each of the Tobacco Endgame interventions predicts a greater reduction in smoking prevalence by 2035 compared to the *status quo* scenario (Table 1 and Figure 1).

Increased taxation had the greatest independent impact on smoking prevalence. By 2035, the smoking prevalence is projected to reach 10.1% with increased tobacco taxes, while the *status quo* prevalence is projected to be 12.9% in 2035 (a 2.8 percentage point reduction).

Decreased tobacco availability is projected to reduce smoking prevalence by 1.5 percentage points in 2035, from 12.9% with the *status quo* scenario to 11.4% with fewer tobacco outlets.

Offering free cessation services in primary care and hospital settings (i.e., Ottawa Model for Smoking Cessation model) is projected to reduce smoking prevalence to 12.2% in 2035; while free cessation services offered in primary care, hospitals, offices of health professionals, community and 'other' settings is projected to further reduce smoking prevalence to 12.1% in 2035. Both cessation policy models project lower smoking prevalence in 2035 compared to the *status quo* scenario (12.9% in 2035; a 0.7 and 0.8 percentage point reduction, respectively).

Plain packaging is projected to reduce smoking prevalence by 0.6 percentage points in 2035, from 12.9% with the *status quo* scenario to 12.3% with plain packaging.

When all four Tobacco Endgame interventions were assessed simultaneously in Ontario SimSmoke, the combined effect projected a reduction in smoking prevalence to 8.5% in 2035, a 4.4 percentage point reduction compared to the *status quo* scenario (12.9% in 2035).

2018	2019	2020	2025	2030	2035
15.5%	15.4%	15.2%	14.4%	13.6%	12.9%
15.5%	14.8%	14.7%	13.8%	13.0%	12.3%
15.5%	14.8%	14.7%	13.8%	13.0%	12.2%
15.5%	14.7%	14.5%	13.6%	12.8%	12.1%
15.5%	13.7%	13.5%	12.7%	12.0%	11.4%
15.5%	12.7%	12.5%	11.7%	10.8%	10.1%
15.5%	10.9%	10.7%	9.9%	9.1%	8.5%
	2018 15.5% 15.5% 15.5% 15.5% 15.5%	2018 2019 15.5% 15.4% 15.5% 14.8% 15.5% 14.7% 15.5% 13.7% 15.5% 12.7% 15.5% 10.9%	20182019202015.5%15.4%15.2%15.5%14.8%14.7%15.5%14.8%14.7%15.5%13.7%13.5%15.5%12.7%12.5%15.5%10.9%10.7%	2018 2019 2020 2025 15.5% 15.4% 15.2% 14.4% 15.5% 14.8% 14.7% 13.8% 15.5% 14.8% 14.7% 13.8% 15.5% 14.7% 13.6% 15.5% 15.5% 14.7% 14.5% 13.6% 15.5% 13.7% 13.5% 12.7% 15.5% 12.7% 12.5% 11.7% 15.5% 10.9% 10.7% 9.9%	2018201920202025203015.5%15.4%15.2%14.4%13.6%15.5%14.8%14.7%13.8%13.0%15.5%14.8%14.7%13.8%13.0%15.5%14.7%13.6%12.8%15.5%13.7%13.5%12.7%12.0%15.5%12.7%12.5%11.7%10.8%15.5%10.9%10.7%9.9%9.1%

Table 1: SimSmoke Model Predicted Smoking Prevalence, for Both Sexes, Ages 15-85, With andWithout Tobacco Endgame Policies, Ontario, 2018-2035 (Abbreviated)

^a Status quo represents the policy levels prior to the first projection year (2019)

Source: Ontario SimSmoke





^a Status quo represents the policy levels prior to the first projection year (2019) Note: Full data table for this graph provided in the Appendix (Table 2) Source: Ontario SimSmoke In the model assessing the impact of a higher minimum age for legal purchase, population smoking prevalence was expected to decline 3.7 percentage points by 2035 to 13.2%, from an imputed value of 16.9% under the baseline *status quo* scenario. Increasing the minimum legal purchase age to 21 would be expected to reduce smoking prevalence to 10.5% (8.0% among the 20-34 year olds; 2.7 and 5.2 percentage point decrease, respectively). Eliminating the effect on cessation in the model would predict a 2035 prevalence of 11.2% (10.8% among the 20-34 year olds; 2.0 and 2.4 percentage point decrease, respectively).





Note: Full data table for this graph provided in the Appendix (Table 3)

Discussion

The modelling results presented in this report highlight the effects of five potential Tobacco Endgame interventions to reduce the smoking prevalence in Ontario by the year 2035. Increasing the tobacco taxes had the greatest independent predicted decrease in smoking prevalence by the year 2035 (10.1%), followed by increased minimum age for legal purchase to 21 years (10.5%) and decreasing the number of tobacco outlets (11.4%). Offering free cessation services and introducing plain packaging on all tobacco products each reduced the smoking prevalence by less than 1 percentage point compared to the *status quo*. Notably, none of the Tobacco Endgame interventions (either independently or combined) projected a smoking prevalence that was less than 5% by 2035. Further consideration should be given to implementing more Tobacco Endgame interventions simultaneously to achieve the goal in 2035. Caution should be taken when interpreting the projections presented in this report as they depend on the reliability of the data, and the estimated parameters and assumptions used in the models.

Appendix

Table 2: SimSmoke Model Predicted Smoking Prevalence, for Both Sexes, Ages 15-85, With and Without Tobacco Endgame Policies, Ontario,2018-2035 (Full)

Policy	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Status Quo Policies ^a	15.5%	15.4%	15.2%	15.0%	14.9%	14.7%	14.5%	14.4%	14.2%	14.0%	13.9%	13.7%	13.6%	13.4%	13.3%	13.1%	13.0%	12.9%
Independent Policy Effects																		
Plain packaging	15.5%	14.8%	14.7%	14.5%	14.3%	14.2%	14.0%	13.8%	13.6%	13.5%	13.3%	13.1%	13.0%	12.8%	12.7%	12.5%	12.4%	12.3%
Free cessation services in primary care and hospitals	15.5%	14.8%	14.7%	14.5%	14.3%	14.2%	14.0%	13.8%	13.6%	13.5%	13.3%	13.1%	13.0%	12.8%	12.7%	12.5%	12.4%	12.2%
Free cessation services everywhere	15.5%	14.7%	14.5%	14.3%	14.2%	14.0%	13.8%	13.6%	13.5%	13.3%	13.1%	13.0%	12.8%	12.6%	12.5%	12.3%	12.2%	12.1%
Decreased tobacco availability	15.5%	13.7%	13.5%	13.4%	13.2%	13.1%	12.9%	12.7%	12.6%	12.4%	12.3%	12.1%	12.0%	11.8%	11.7%	11.6%	11.5%	11.4%
Increased taxation	15.5%	12.7%	12.5%	12.4%	12.2%	12.0%	11.8%	11.7%	11.5%	11.3%	11.1%	11.0%	10.8%	10.6%	10.5%	10.3%	10.2%	10.1%
Combined Policy Effects																		
All above	15.5%	10.9%	10.7%	10.6%	10.4%	10.2%	10.1%	9.9%	9.7%	9.6%	9.4%	9.3%	9.1%	9.0%	8.9%	8.7%	8.6%	8.5%

^a Status quo represents the policy levels prior to the first projection year (2019) Note: Data table is for Figure 1. Table 3: Model Predicted Smoking Prevalence, for Both Sexes, With and Without Increased MinimumAge Tobacco Purchasing Law, Ontario, 2018-2035

Year	Prevela	Prevelance (%)						
	Minimum Age 21	Baseline Prediction						
2018	16.9	16.9						
2019	16.2	16.6						
2020	15.8	16.4						
2021	15.5	16.2						
2022	15.1	15.9						
2023	14.7	15.7						
2024	14.4	15.5						
2025	14.0	15.2						
2026	13.7	15.0						
2027	13.3	14.8						
2028	13.0	14.6						
2029	12.7	14.4						
2030	12.3	14.2						
2031	11.9	14.0						
2032	11.5	13.8						
2033	11.2	13.6						
2034	10.8	13.4						
2035	10.5	13.2						

Note: Data table is for Figure 2.

References

¹ Zhang B, Shwartz R. The Effect of Tobacco Control Strategies and Interventions on Smoking Prevalence and Tobacco Attributable Deaths in Ontario, Canada: Technical Report of the Ontario SimSmoke. Toronto, ON: Ontario Tobacco Research Unit, July 2013. Accessed January 15, 2019.

² Chaiton MO, Mecredy G, Cohen J. Tobacco retail availability and risk of relapse among smokers who make a quit attempt: A population-based cohort study. *Tobacco Control* 2018 Mar;27(2):163-169.

³ A Tobacco Endgame for Canada: Summit Background Paper. Kingston, ON: Queen's University, August 2016. Accessed January 15, 2019.

⁴ Callaghan RC, Sanches M, Gatley J, Cunningham JK, Chaiton MO, Schwartz R, Bondy S, Benny C. Impacts of Canada's minimum age for tobacco sales (MATS) laws on youth smoking behaviour, 2000-2014. *Tobacco Control* 2018;27(e2). doi:10.1136/tobaccocontrol-2017-053869.