Published in final edited form as:

Tob Regul Sci. 2015 April ; 1(1): 61–75.

Public Health Effects of Restricting Retail Tobacco Product Displays and Ads

David T. Levy, PhD,

Professor, Georgetown University, Lombardi Comprehensive Cancer Center, Washington, DC.

Eric N. Lindblom, JD,

Georgetown University, Law Center, O'Neill Institute for National & Global Health Law.

Nancy L. Fleischer, PhD,

University of South Carolina, Department of Epidemiology and Biostatistics, Education, and Behavior, Columbia, SC.

James Thrasher, PhD,

University of South Carolina, Department of Health Promotion, Education, and Behavior, Columbia, SC.

Mary Kate Mohlman, PhD,

Epidemiologist, Georgetown University, Lombardi Comprehensive Cancer Center, Washington, DC.

Yian Zhang, MS,

Research Assistant, Georgetown University, Lombardi Comprehensive Cancer Center, Washington, DC.

Karin Monshouwer, PhD, and

Trimbos Institute (Netherlands Institute of Mental Health and Addiction), Utrecht, The Netherlands.

Gera E. Nagelhout, PhD

Maastricht University (CAPHRL), Department of Health Promotion, Maastricht, The Netherlands.

Abstract

Objectives—To estimate the public health impact from restricting US retail point-of-sale (POS) tobacco product displays and advertising.

Methods—Based on existing research, this paper estimates the effects on initiation and cessation rates from restricting POS tobacco product displays and ads in the US and uses the SimSmoke simulation model to project related smoking declines and health benefits.

Correspondence Dr Levy; dl777@georgetown.edu.

Human Subjects Statement

This study uses only publicly accessible data and consequently is declared exempt.

Conflicts of Interest Statement

None are reported.

Results—New comprehensive POS restrictions are projected to reduce smoking prevalence by approximately 16% [range=3%–31%] relative to the status quo by 2065, preventing about 630,000 smoking-attributable deaths [range=108,000–1,225,000], 215,000 low birth weight births [range=33,000–421,000], 140,000 preterm births [range=22,000–271,000], and 1900 infant deaths from SIDSs [range=300–3800].

Conclusions—Federal, state, or local action to restrict POS tobacco product displays and ads would contribute to a substantial reduction in smoking-attributed death and disease.

Keywords

smoking; modeling; SimSmoke; retail; point-of-sale; public health

The 1998 Master Settlement Agreement (MSA) between the major cigarette companies and the states sharply restricted outdoor cigarette advertising in the United States. Visible tobacco product displays and other advertising inside retail outlets at point-of-sale (POS), however, remained largely unconstrained. Following the MSA, the major cigarette companies increased their focus on POS marketing.

In 2011, approximately 95% of the \$8.8 billion in cigarette marketing expenditures went to advertising, price discounts, promotional allowances, and value-added items at retail, compared to only 80% of their \$6.7 billion in 1998.¹ Part of these expenditures went toward contracts giving the cigarette companies direct influence over retail product placement, advertising placement, and pricing through financial incentives.^{2,3} In California, retailers subject to these contracts had on average 26.6 cigarette marketing materials per store compared to 15.9 in non-participating stores.⁴ Tobacco products displays and ads also were placed prominently in stores, often with warning labels hidden but with the company branding visible.^{4,5}

Marketing at POS is effective because of the large number of tobacco retailers nationwide and the many times consumers, including youth, enter retail stores. By one conservative count, there are 374,600 tobacco retailers in the US, which equates to 28 tobacco retailers for every single Starbucks and 27 for every McDonalds.⁶ Three out of 4 teenagers shop at a convenience store at least once a week,⁷ staying an average of 16 minutes per visit (twice as long as adults).⁸ Moreover, retail density is typically highest in minority and low-income communities,^{6,9–11} where POS tobacco product displays work directly to increase health disparities.

Empirical studies consistently have found that exposure to POS tobacco product displays are associated with increased initiation among youth and reduced cessation by current smokers. For example, a 2009 systematic review¹² found that POS tobacco product displays and advertising were associated with increased youth smoking susceptibility, experimentation and initiation, with exposure to displays also increasing cravings among current smokers. A 2014 review¹³ of 20 studies also found a positive relationship between POS tobacco marketing and poorer youth and adult smoking-related outcomes. Another 2014 review¹⁴ found that exposure to POS marketing was associated with being a smoker, smoking more cigarettes, urges to smoke, and being susceptible to smoking.

Despite this strong empirical evidence, little has been done in the US to reduce smoking by limiting retail product displays or ads. In 2009, the Family Smoking Prevention and Tobacco Control Act gave the US Food and Drug Administration (FDA) extensive new authority to restrict the marketing, promotion, and sale of cigarettes and smokeless tobacco products. It also reduced the scope of the preexisting federal preemption of state and local measures to restrict cigarette advertising for health purposes, newly permitting them to restrict the time, place, and manner of cigarette advertising. Nevertheless, federal laws and regulations have yet to reach beyond minor constraints on retail tobacco product marketing, and few states or localities have restricted POS tobacco product displays or ads.⁶ Only 9 states and the District of Columbia currently have tobacco advertising restrictions of any kind, and only one of those laws (unrelated to POS) was enacted after 2009.¹⁵ Whereas some localities have considered new tobacco advertising restrictions, they have failed either to implement them because of tobacco industry opposition or have had the laws struck down by industry legal challenges.^{16,17}

This analysis provides the first research-based estimates of the potential public health benefits from implementing new POS restrictions on tobacco product marketing. This paper first reviews existing research to determine the effect of POS displays and advertising on smoking initiation and cessation rates. It then applies the effect sizes from these studies through the *US SimSmoke* tobacco control policy simulation model to estimate the impact of implementing comprehensive restrictions on POS displays and related advertising on smoking rates and smoking-attributable health outcomes, including deaths, low birth weight (LBW) births and preterm births (PTB).

METHODS

Literature Review of the Estimated Effects of Point-of-Sale Displays/Marketing

Identifying relevant research included a search of PubMed using such terms as “point of sale,” “retailer restrictions,” and “tobacco” or “cigarette” and “marketing,” complemented by a search of bibliographies from prior reviews and meta-analyses.^{12–14} Although the identified studies also considered other outcomes, our analysis focuses on those studies that provide evidence on the effect of POS exposure on initiating, impulse buying, quitting, and relapsing back to smoking, which relate most directly to smoking prevalence.

The identified studies typically considered adolescents and young adults (under 24 years old) or else adults (18 years and above). Some considered the effect of retailer visits or recall of POS displays in areas where POS displays or ads were prevalent. Others looked at the impact of new POS display and advertising bans in other countries.^{18–21}

Youth initiation—McNeil et al²⁰ studied POS display ban in Ireland and found no significant change in youth smoking just one month afterwards, possibly too short a period to see any youth changes. However, they found that 38% reported that initiation was likely due to the ban. After adjusting for other tobacco control policies, White et al²² found that Australia’s initial ban on mass media tobacco advertising, including ads at POS, did not reduce smoking, possibly because highly visible POS tobacco product displays were still allowed and prevalent. Bivariate analysis indicated a 5% reduction with advertising

restrictions. Examining the impact of the POS display ban in Australia, Dunlop et al¹⁸ found that 14% of 12–24 year-olds were current smokers before the POS ban, dropping to 11% at 24 months after the ban, a 20% relative reduction; they also obtained an adjusted odds ratio (AOR) of 0.73 with a 95% confidence interval (CI) of (0.55, 0.96). These estimates as applied to the US may be conservative, because the display ban was implemented after most other advertising already had been prohibited. In the US, tobacco product displays *and* advertising are both prevalent and largely unrestricted, suggesting that the reduced exposure to displays and ads after new POS restrictions in the US could be greater than the effects estimated by Dunlop et al¹⁸ and the other display ban studies (even if the US could only approximate a total display and advertising ban because of First Amendment Constraints).

For the US, Slater et al²³ found a positive association between increased POS advertising, advertised prices, and promotions (coupons and self-service placement) and youth progression from a non-recent experimenter to experimenter (AOR 1.22: 95% CI 1.01, 1.48) or to current established smoker (AOR 1.38: 95% CI 1.11, 1.72). That study also estimated that, if all stores used all the POS promotions, the prevalence of current established smoking would increase by 16.6%, but prevalence would decline by 13.4% if all such POS promotions were eliminated. Also in the US, Henriksen et al²⁴ found that the two-thirds of middle school students exposed to retail tobacco marketing at least once per week had a 50% increased odds of ever smoking compared to those with less retail exposure, and Kim et al²⁵ found a greater odds of being a current smoker (AOR 1.57, 95% CI 1.01, 2.44) among youth living in New York counties with more retail price promotions. Similarly, Lovato et al²⁶ found that smoking was higher in Canadian schools in neighborhoods with more advertised cigarette promotions and lower prices.

Studies also have found a dose-response relationship between retailer visits and smoking. In New Zealand, Paynter et al²⁷ found that youth aged 14–15 who visited stores at least daily had a 2.7 (95% CI 2.4, 3.1) higher odds of experimenting with smoking and 2.5 higher odds of being current smokers compared to less frequent visitors. Among 13–15 year-old Norwegians, Braverman et al²⁸ found that the odds of being a current smoker among students reporting exposure to POS marketing at 5 different locations was more than twice as high both in 1990 (AOR = 2.1, 95% CI 1.53, 2.95) and in 1995 (AOR = 2.3, 95% CI 1.62, 3.14) compared to students who reported no exposures, implying increases in smoking compared to students who reported no marketing exposures of about 16% (0.076*2.1 and 0.066*2.25). For students reporting 3–4 exposures, they obtained AORs of about 2, implying reductions in smoking of 30% (0.175*1.9 and 0.146*2.0). In England, Spanopoulos et al²⁹ found that students who visited a store “almost every day” had 2.23 higher odds (95% CI 1.40, 3.55) of being ever smokers compared to those who frequented a store less than once per week, and students who visited a store 2–3 times per week had 70% higher odds of having ever smoked.

In the US, Feighery et al³⁰ found that middle school youth who visited stores selling tobacco products at least weekly (54% of students) had twice the odds (AOR: 2.01, 95% CI 1.54, 2.62) of having ever smoked compared to those who went less than weekly. In a New York City survey, Johns et al³¹ found that 2 or more visits per week to retailers selling tobacco was associated with a 40% increased odds of smoking initiation (95% CI 1.08, 1.84).

Henriksen et al³² found that California middle school youth who visited stores more than twice per week had 2.58 times higher odds (95% CI 1.68, 3.97) of having started to smoke within 12 months, and those who visited stores less than twice per week had 1.64 times higher odds (95% CI 1.06, 2.55), compared to those with minimal visits (less than twice per month). At 30 months, the odds of becoming a smoker was 1.42 (95% CI 1.19, 1.69) for those visiting more than twice per week and 1.19 (95% CI 1.00, 1.41) for those visiting less than twice per week compared to minimal visits.

Whereas the studies of existing POS marketing are potentially subject to selection bias (ie, a greater tendency of smokers to visit stores to buy cigarettes and the likelihood of tobacco selling stores to cluster in higher smoking areas), the studies support a finding that sharply restricting POS displays and ads will reduce smoking among youth. Based on Slater et al²³ and 2 of the more conservative exposure studies,^{28,32} we estimate that eliminating all advertising and price promotions from their current levels at POS would reduce youth tobacco use initiation by 13%. Studies indicate that the 50% of middle school students who frequent retail stores more regularly have twice the odds of becoming a smoker, and the 50% or more of youth in areas with more retail POS displays are also 50% more likely to become smokers.^{27,29,31} Based on those studies and Dunlop et al¹⁸ (taking into account that strong advertising restrictions were already in place), an upper range of a 25% reduction in initiation is adopted.¹⁸ Despite the robustness of the available research on the power of POS tobacco product and ad exposure to increase youth initiation, we set a 2% reduction as our lower bound, conservative bound estimate.

Adult smoking behaviors—Four of the 11 studies on the impact of POS tobacco displays and marketing on adult smoking examined the effects of implementing a display ban after a previous ban on other tobacco advertising. McNeil et al²⁰ did not find any significant change in adult prevalence after one month following Ireland's display ban, but found that 14% of smokers thought that the ban would make quitting easier 7 months post ban was implemented.²⁰ Looking at the same ban over a one-year period, Quinn³³ found no significant decline in unit cigarette sales other than continuations of prior downward trends. Because successful cessation among established smokers in any given year is low, however, even a 10% increase in the normal cessation rate would have little impact on pack sales in the short term. In addition, a US industry marketing report claimed that POS advertising increased cigarette sales by 18% in the US, suggesting comparable declines, over time, from minimizing POS displays and advertising.³⁴

Using data from the International Tobacco Control (ITC) 4 Country Survey, Li et al²¹ found that 2.5% of smokers "bought unplanned cigarettes due to display" in countries with a display ban compared to 6.1% of smokers in countries without a ban, suggesting a 59% (2.5/6.1) reduction in unplanned purchases increasing from 52% (4.2/8.7) in the preceding year. They also found a 61 % lower odds of an unplanned purchase with a ban (AOR: 0.39, 95% CI 0.27, 0.54). After a display ban in Western Australia was implemented, Carter et al³⁵ found that unplanned cigarette purchases decreased 30%, which was confirmed in a more recent study,¹⁹ and also found a 5-to-6-fold reduction in the proportion of smokers suggesting displays influenced their purchase decision.

In areas without retailer advertising restrictions in place, Wakefield et al³⁶ found that noticing tobacco displays showed a positive association with unplanned cigarette purchases (OR: 2.49, 95% CI 1.29, 4.80), which in turn, was negatively associated with considering quitting (OR: 1.82, 95% CI 1.06, 3.13). Clattenburg et al³⁷ found that unplanned purchases in response to exposure to retail cigarette displays was more common among those trying to quit, such as smokers who made 3+ quit attempts in the previous year (OR: 2.4, 95% CI 0.9, 6.0), those who planned to quit in the next month (OR: 3.7, 95% CI 1.6, 9.0), and the 31% who agreed that tobacco POS advertising makes quitting smoking harder (OR: 2.3, 95% CI 1.1, 4.8). From post-purchase interviews, Carter et al³⁸ found that the 47% of daily smokers who made an unplanned purchase stated that they were influenced by retail displays at POS compared to 12% of those making a planned purchase.

Germain et al³⁹ categorized smokers as high, medium, and low sensitivity to POS displays based on interview questions about how often displays were noticed, frequency of unplanned cigarette purchases, and whether displays influenced brand of cigarette purchase. Compared to the low-sensitivity group, the odds of quitting were 30% for medium-sensitivity (OR: 0.32, 95% CI 0.14, 0.74) and high-sensitivity respondents (OR: 0.27, 95% CI 0.08, 0.91). With 17% of smokers quit at 18-month follow-up, the results indicate 70% lower odds of higher quit rates for the 66% in either high or medium sensitivity groups, more than a 50% reduction (0.66*0.7).

Looking at POS displays and relapse, Hoek et al⁴⁰ interviewed 20 smokers who had recently tried to quit, and most reported cravings when they saw displays. In a diary-style study, Burton et al⁴¹ assessed the impact of tobacco displays on the number of purchases by smokers in 4-hour windows during a 4-day period. They found that exposure led to an increased odds of smoking (OR: 1.45, 95% CI 1.36, 1.55) and smoking more cigarettes (OR: 1.21, 95% CI 1.16, 1.26). Of those attempting to quit, 27% smoked during the 4-day period and 18.9% bought cigarettes. Kirchner et al⁴² found that lapses during the first month after a smoker had quit were 19% higher on days with a POS exposure to retail marketing (OR: 1.19, 95% CI 1.18, 1.20), and that the daily probability increased with more POS exposures (OR: 1.07, 95% CI 1.06, 1.08). Increased exposure to POS displays increased the overall odds of relapsing by 26% (OR: 1.26, 95% CI 1.11, 1.38) when cravings were low, with higher levels of craving more directly associated with lapse outcomes. With about half of smokers ordinarily relapsing between one month and one year,⁴³ these results suggest a 13% increase in quit success after one year due to POS display bans.

All of the reviewed research, other than the 2 Ireland studies, directly supports a finding that sharply reducing tobacco product displays and advertising in the US will increase cessation among existing smokers (and one of the Ireland studies found cessation-supporting changes to smoker beliefs).²⁰ Whereas none of the studies explicitly estimates the effect of POS restrictions on quit rates, Kirchner⁴¹ directly examined quitting behaviors associated with POS exposure. Based primarily on that study, analyzed in the context of all the other described research, we estimate that a POS ban on price promotions and tobacco product displays, with comprehensive restrictions on other publicly visible tobacco advertising, would increase cessation rates by 13%. An upper bound estimate of a 26% increase in cessation rates is based on Burton et al⁴¹ and Germaine et al.³⁹ To be conservative and

account for possible First Amendment constraints, we use a 2% increase in the cessation rate as a lower bound, which would lead to < 0.01% reduction in prevalence if 4% of smokers quit.

The SimSmoke Tobacco Control Policy Model

SimSmoke is a well-established and validated compartmental (macro-) simulation model that has been developed and used for estimating the impact of different tobacco control interventions for the US, 10 states and more than 40 other countries.^{44–54} A recent version of *US SimSmoke* is used, which has been validated over a 50-year period for 1965 through 2014.

US SimSmoke begins in 1965 with the number of current, former, and never smokers by age and sex, using 1965 smoking prevalence rates from the National Health Interview Survey (NHIS) and population data (actual and projected through 2065) from the US Census. Using age- and sex-specific smoking initiation, cessation and relapse rates, a discrete time, first-order Markov process is assumed in projecting future smoking prevalence rates by age and sex by year. Smoking rates are projected through 2014 allowing for actual changes in policy levels. Separate policy modules estimate the effect of tax changes, smoke-free air laws, marketing restrictions, mass media campaigns, cessation treatment, and youth access policies. The original policy parameters are based on literature reviews⁵⁵ and the advice of an expert panel.

Smoking-attributable deaths (SADs) are defined in terms of excess death rates of current smokers (mortality rate of current smoker minus mortality rate of never smoker) and similarly for former smokers. Age- and sex-specific current, former and never smoker mortality rates are based on the Cancer Prevention Studies (CPS I and II) and the Nutrition Follow-up Studies.⁵⁶ Based on the CPS-II,⁵⁷ former smokers mortality rates decline with years quit. For current and former smokers, SADs are calculated as a product of stratum-specific excess death risk, prevalence, and population. For a given year, SADs are summed over all ages.

The model also estimates smoking-attributable low birth weight (LBW), pre-term births (PTBs) and sudden infant death syndrome (SIDS) cases. The number of cases is determined by their smoking-attributable fraction multiplied by the number of each of the outcomes by age and sex.⁵⁸ The rates of LBW, PTB and SIDS were obtained from the CDC WONDER database⁵⁹ for 2012, and assumed to be constant over time. These rates are multiplied by the number of births, based on fertility rates from the US Census projected through 2065. Because the projected rates are not distinguished by age, we assume that the age distribution of mothers from 2012 continues in future years. Prenatal smoking rates in 2012 are derived using birth certificate data and adjusted for failure to report using recent estimates.⁶⁰ We calibrated the 2012 smoking prevalence from *SimSmoke* to the adjusted NCHS maternal smoking prevalence by determining adjustment factors that equilibrated smoking prevalence to the adjusted maternal smoking prevalence. Future maternal smoking prevalence then varied proportionately to rates for all females of the same age. Relative smoking risks are based on the 2004 Surgeon General's Report⁶¹ for LBW (2.0) and SIDS (2.3) and on

Anderka et al⁶² and Aliyu et al⁶³ for PTB (1.3). We assumed that the impact of POS restrictions had the same impact on pregnant as non-pregnant women.

The Effects of POS Restrictions on Smoking Rates and Health Outcomes

To estimate the effect of implementing comprehensive POS advertising and display restrictions, *status quo* smoking rates are first projected from 2015 to 2065 by assuming that policies remain constant at their 2014 levels. The effects from the comprehensive restrictions are then estimated assuming enactment in 2015. Based on our review of existing research, the best estimate for such comprehensive restrictions on POS tobacco product price discounts, displays, and advertising is a 13% reduction in youth smoking initiation with lower and upper bounds of 2% to 25% and a 12% increase in smoking cessation with a range of 2% to 26%.

Applying both the initiation and cessation effects from the POS restrictions, *SimSmoke* is used to calculate the best estimate and a plausible range for smoking prevalence. The effects of the restrictions on smoking prevalence are measured by the change in smoking prevalence as a result of new restrictions relative to the status quo level of smoking prevalence in a particular year. SADs, LBW, PTB and SIDS cases averted are calculated as the difference between the status quo level and the level with the POS restrictions in a particular year. Those estimates are each summed over a 50-year period (through 2065), which serves as a gauge of the cumulative effect on the population alive in 2014.

RESULTS

Projected smoking prevalence (ages 18 and above) from *US SimSmoke* by sex for the years 2014 through 2065 are shown in Table 1 and Figure 1. The smoking prevalence in 2014 under the *status quo* is 20% for males and 15% for females and declines slowly to 15% for males and 11% for females by 2065. With new comprehensive restrictions on POS displays and in-store advertising implemented in 2015, male smoking prevalence in 2020 is projected to decline by 4% relative to the status quo level with a plausible range of 0.6% to 8% (indicated by [range=0.6%-8%]), increasing to a relative decline of 16% [range=3%-31%] by 2065. Female smoking prevalence declines by 3% [range=0.5%-7%] by 2020, less than for males, but would achieve the same rate of decline as males by 2065. The effects on smoking prevalence increase over time due to the continuing effect of the policy on cessation at all ages and on initiation by youth and young adults who become an increasing proportion of the adult population over time.

Table 2 and Figure 2 show estimated SADs and the number of deaths averted due to the new POS restrictions. Under the status quo, SADs are estimated at 280,500 males and 174,400 females in 2014 declining to 169,000 males and 102,000 females by 2065. With POS restrictions, 50 [range=8–105] SADs (including both males and females) would be averted in 2015. This number increases to almost 1400 [range=230–2,800] in 2020 and to almost 25,000 [range=4000–47,000] in 2065, 10% of the total SADs in that year. From 2015 to 2065, the aggregate number of SADs that would be averted is 630,000 [range=108,000-1,225,000], representing 3% of total SADs.

The effects of POS restrictions on smoking-attributable adverse maternal and child health outcomes are presented in Table 3. The model projects 34,000 LBW, 21,000 PTB and 320 SIDS cases under the status quo in 2015. These numbers increase to 46,000 LBW, 28,000 PTB and 435 SIDS cases by 2065. Over the period 2015 to 2065, the cumulative numbers of outcomes are 2,008,000 LBW, 1,220,000 PTB and 19,000 SIDS. With POS restrictions, the model projects that LBW cases would decline by 2100 [range=300–4,200] in 2020, 5000 [range=800–9,700] in 2045 and, 600 [range=900–11,000] in 2065. Between 2015 and 2065, the model projects that a total of 215,000 [range=33,000–421,000] LBW cases would be averted. For PTBs, *SimSmoke* projects a reduction of 1400 [range=200–2,700] cases in 2020, increasing to 3700 [range=600–7,100] in 2065, and 140,000 [range=22,000–271,000] cumulative averted PTBs from 2015 to 2065. For SIDS, the number of averted cases would be 20 [range=3–40] in 2020 and 50 [range=8–98] in 2065, summing to 1900 [range=300–3,800] cumulative cases.

DISCUSSION

The *US SimSmoke* model projected substantial reductions in smoking rates, and smoking-attributable deaths and LBW, preterm births, and SIDS cases as a result of banning POS displays, price discounts, and sharply restricting visible POS advertising. The decrease in smoking-attributable death averages 3% over the period 2015 to 2065, but higher rates of deaths are averted in later years due to the delayed effects of quitting on relative mortality risks. A major impact is also projected for adverse smoking-attributable birth outcomes, reducing the number of LBW and PTB births by about 11% and of SIDS deaths by 10%. The effects are quicker than for mortality, due to the immediate effect on initiation and cessation among females of child-bearing ages.

Whereas many studies showed that increased POS exposure was associated with increased initiation, unplanned buying, and reduced cessation, few specifically showed a direct link between the presence of POS restrictions and initiation or cessation. Accordingly, we provided large ranges for the upper and lower bounds, reflecting the large variation in results and the heterogeneity of study designs and aims. Henriksen et al³² provided one of the few longitudinal studies for youth and the strongest causal link between POS displays and smoking initiation. Model projections would be improved with more longitudinal studies that incorporate stratification by age and sex, as well as studies of the impact of display and advertising restrictions on smoking prevalence over longer time horizons while adjusting for other tobacco control measures.

Although not directly included in our analysis, further support for the projections is provided by studies finding reduced smoking susceptibility and anti-smoking norms from reduced POS exposure. Using a validated measure of “cognitive predisposition” to smoke,⁶⁴ youth POS exposure has yielded odds ratios of susceptibility ranging from 1.25 to 3.3.^{30,65} After display bans, youth’s perceived access to tobacco products decreased⁶⁶ and they were 16% less likely to overestimate peer smoking prevalence.¹⁸ In Norway, consumers believed that the display ban contributed to tobacco denormalization.⁶⁷ Other studies^{14,68,69} examining the relationship between retailer density and youth smoking provide additional support for

limiting retail promotion, with one modeling study⁷⁰ showing the potential to reduce smoking by restricting the number of sales outlets.

We have modeled a ban on POS displays and advertising implemented at a national level. Similar effects would be expected at state and local levels, with the effects on health outcomes scaled to the number of smokers by age and sex in those areas. However, restrictions at a federal level would not only be more comprehensive but would ensure implementation in states where smoking rates are highest and also offer greater federal resources to withstand industry challenges. This study and the underlying research suggest that it would be “appropriate for the public health” for FDA to move forward with implementing strong, new restrictions on POS tobacco product displays and advertising to reduce smoking and related harms.⁷¹

The public health benefits from new POS restrictions will depend on compliance and the extent that exposure to the displays and advertising is reduced. Compliance does not appear to be a problem in countries that have implemented a ban,^{20,67} but the effectiveness of POS restrictions may be reduced if manufacturers continue to be allowed to provide retailers with promotional allowances to reduce retail prices. Lower advertising costs might, however, lead to lower prices, unless manufacturers and retailers increase expenditures on other forms of marketing that is still permitted. The effects of POS implementation also will depend on the status of displays for alternative nicotine-delivery products, such as smokeless tobacco and electronic cigarettes. Continuing to allow the displays of these products could increase their use, possibly leading to future smoking, and might promote dual use instead of cessation of smoking. However, such displays and ads also might encourage switching to lower risk products instead of smoking cigarettes. *SimSmoke* projected 50 years into the future to gauge the effect on smokers alive today. These long-term projections may be less valid if the industry adopts effective alternative marketing strategies, such as increased internet promotions.⁷²

Although not considered, additional benefits may be realized, especially among lower SES groups,⁷³ if new POS restrictions are implemented along with other tobacco control measures, such as replacing POS displays with public warnings,⁷⁴ limiting Internet promotions, and graphic warnings on cigarette packages^{75,76} We did not distinguish effects by SES or racial/ethnic groups, but retail tobacco marketing is particularly prominent in low SES areas. Consequently, restricting POS exposure may be especially effective at reducing the high smoking rates among those of low SES, thereby, reducing smoking-related health disparities.

The results presented here depend on the data and assumptions in the *SimSmoke* model.^{77–79} In particular, the effects on smoking prevalence depend on the initiation and cessation rates in the model, as projected over time. In addition, *SimSmoke* does not distinguish by racial/ethnic group or SES, and does not reflect immigration. However, when validated against NHIS smoking prevalence rates, the model predicted well by sex from 1965–2012 and predicted well by age, except for some male age groups, from 1980–1995.

The estimated effects on smoking-attributable birth outcomes are also subject to limitations. The number of future adverse maternal outcomes depends on projected fertility rates; the relative risks of prenatal smoking are assumed constant over time and across age groups; and the analysis does not distinguish the overlap in diagnosis between LBW babies and PTBs. We also assume that POS policies have the same relative effect on pregnant females as on the general female population. However, *SimSmoke* projected impacts of taxes and smoke-free policies on adverse birth outcomes are similar to those found in empirical studies of tax and smoke-free air policies, suggesting the validity of that approach.^{80–83}

Because of First Amendment protections of commercial speech, including tobacco product advertising, complete bans of both tobacco product displays and ads at retail, as in other countries, would not likely be permitted in the US,⁸⁴ which might limit the extent to which new restrictions could reduce exposure at retail. US Supreme Court rulings establish that any new restrictions on POS advertising must not be overly broad, and must leave sellers with adequate ways to communicate to customers about the products.⁸⁴ Within those constraints, however, POS displays and advertising could still be sharply reduced, closely approximating the reduced involuntary exposures to colorful branding and images secured by total ad and display bans. One possibly viable approach might be to prohibit POS product displays and most publicly visible POS advertising, but allow text-only signage at retailers to notify customers of the availability of specific tobacco products and their prices and allow retailers to provide minimally restricted advertising materials directly to verified adult customers.^{85–87}

IMPLICATIONS FOR TOBACCO REGULATION

This study responds to the FDA's need for more estimates of the public health impact of POS marketing restrictions. The extensive literature on POS displays shows a strong association between POS displays and advertising and increased smoking initiation and relapses and decreased cessation. Based on available research, the *SimSmoke* model projects that new POS display and advertising restrictions in the US would substantially reduce smoking prevalence, smoking-attributable deaths, and both LBW and preterm births, especially if implemented nationwide.

Acknowledgments

Funding was received by David Levy from the Food and Drug Administration and National Institute on Drug Abuse under grant 1R01DA036497-01 and the Cancer Intervention and Surveillance Modeling Network (CISNET) of DCCPS, National Cancer Institute under grant U01-CA97450-02. He also received funding from the Dutch Alliance for a Smokefree Society.

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Figure 1.
Male and Female Smoking Prevalence, with and without a POS Display and Advertising Ban, 2014–2065, SimSmoke Projections

Figure 2.
Smoking-Attributable Deaths, With and Without a POS Display and Advertising Ban, 2014–2065, SimSmoke Projections

The Effects of Implementing a POS Display and Advertising Ban in 2015 on Smoking Prevalence, SimSmoke, US, Ages 18 and above, 2014–2065

Table 1

	Male					Female				
	2014	2015	2020	2045	2065	2014	2015	2020	2045	2065
	Smoking Prevalence, %					Smoking Prevalence, %				
Status Quo	20.2	19.9	18.5	15.6	15.2	15.2	15.0	13.9	11.1	10.8
Best Estimate	20.2	19.8	17.8	13.5	12.8	15.2	14.9	13.4	9.7	9.1
Lower Bound	20.2	19.9	18.4	15.3	14.8	15.2	15.0	13.8	10.9	10.5
Upper Bound	20.2	19.6	17.1	11.5	10.5	15.2	14.8	12.9	8.3	7.5
	Relative Change to Status Quo, %					Relative Change to Status Quo, %				
Best Estimate	-	-0.7	-3.8	-13.6	-16.2	-	-0.6	-3.4	-13.1	-16.2
Lower Bound	-	-0.1	-0.6	-2.2	-2.7	-	-0.1	-0.5	-2.1	-2.7
Upper Bound	-	-1.4	-7.6	-26.2	-30.6	-	-1.1	-6.7	-25.2	-30.7

Note.

Relative change in smoking prevalence rates is measured for a particular year as (smoking rate after the display ban-status quo level of smoking rate)/(status quo level of smoking rate), where the status quo is projected assuming that all policies remain at their 2014 rates.

Table 2

The Effects of Implementing a POS Display and Advertising Ban in 2015 on Smoking-Attributable Deaths, SimSmoke, US, Ages 18 and above, 2014–2065

Male	2014	2015	2020	2045	2065	2015–2065
Status Quo	280,464	278,962	271,222	214,957	168,767	11,548,883
Number of Smoking Attributable Deaths						
Number of Deaths Averted from Status Quo						
Best Estimate	-	33	827	9,573	16,489	402,201
Lower Bound	-	6	139	1,643	2,805	68,743
Upper Bound	-	69	1,700	18,727	31,007	780,496
Female	2014	2015	2020	2045	2065	2015–2065
Number of Smoking Attributable Deaths						
Status Quo	174,385	173,609	169,144	141,303	101,961	7,374,748
Number of Deaths Averted from Status Quo						
Best Estimate	-	17	547	5,681	8,275	228,028
Lower Bound	-	3	92	990	1,421	39,420
Upper Bound	-	36	1,125	11,116	15,617	444,440
Total	2014	2015	2020	2045	2065	2015–2065
Best Estimate	-	50	1,375	15,254	24,764	630,229
Lower Bound	-	8	232	2,633	4,227	108,162
Upper Bound	-	105	2,826	29,844	46,624	1,224,936

Note.

Deaths Averted = (Smoking-attributable deaths without policy) minus (Smoking-attributable deaths with policy)

Table 3

Effects of Implementing a POS Display and Advertising Ban in 2015 on Smoking- Attributable LBW, PTB, and SIPS for Mothers Aged 15–49, SimSmoke, 2014–2065

LBW	2014	2015	2020	2045	2065	2015–2065
Number of Smoking Attributable LBW Births						
Status Quo	34,082	34,219	34,759	40,976	46,373	2,007,663
Number of LBW Births Averted from Status Quo						
Best Estimate	-	406	2,125	4,980	5,647	215,486
Lower Bound	-	63	328	768	871	33,238
Upper Bound	-	792	4,178	9,725	11,027	421,279
PTB	2014	2015	2020	2045	2065	2015–2065
Number of Smoking Attributable PTB Births						
Status Quo	20,742	20,819	21,132	24,906	28,186	1,220,342
Number of PTBs Averted from Status Quo						
Best Estimate	-	269	1,402	3,223	3,654	139,773
Lower Bound	-	42	217	501	568	21,708
Upper Bound	-	523	2,735	6,244	7,078	271,058
SIDS	2014	2015	2020	2045	2065	2015–2065
Number of Smoking Attributable SIDS Deaths						
Status Quo	320	321	325	385	435	18,832
Number of Deaths Averted from Status Quo						
Best Estimate	-	4	20	44	50	1,918
Lower Bound	-	1	3	7	8	294
Upper Bound	-	8	40	86	98	3,777

Note.

LBW= Low birth weight babies, PTB = preterm births, SIDS = Sudden Infant death Syndrome