

Impact of *The Real Cost* Media Campaign
on Youth Smoking Initiation

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Introduction: The purpose of this study was to assess the relationship between youth exposure to the U.S. Food and Drug Administration's national tobacco public education campaign, *The Real Cost*, and changes in smoking initiation.

Methods: From November 2013 to November 2016, a longitudinal study of youth was conducted with a baseline and 4 post-campaign follow-up surveys. The sample consisted of nonsmoking youths from 75 U.S. media markets ($n=5,103$) who completed a baseline and at least 1 follow-up survey. Exposure was measured by media market-level target rating points and self-reported ad exposure frequency. Smoking initiation was examined among youths who had never smoked at baseline and defined as first trial of a cigarette. Discrete-time survival models using logistic regression and controlling for confounding influences were estimated. Analyses were conducted in 2018.

Results: The odds of reporting smoking initiation at follow-up was lower among youths in media markets with higher levels of campaign advertisements than among those with less. Both between-wave and cumulative target rating points were associated with decreased risk of smoking initiation (AOR=0.69 [$p<0.01$] and AOR=0.89 [$p<0.05$], respectively); for every 3,500 between-wave target rating points on air, there was an associated 30% reduction in the hazard of smoking initiation among youths. Results from self-reported recall of the campaign advertisements found similar dose-response effects. The campaign is associated with an estimated 380,000–587,000 youths aged 11–19 years being prevented from initiating smoking nationwide.

Conclusions: Sustained national tobacco public education campaigns like *The Real Cost* can change population-level smoking initiation among youths, preventing future generations from tobacco-related harms.

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INTRODUCTION

Despite significant progress in reducing tobacco use in the U.S., smoking remains the leading cause of preventable disease and death; 480,000 people die annually from smoking-related illnesses.¹ Each year, approximately 733,000 youths smoke their first cigarette.² Public education campaigns have been found to reduce youth smoking prevalence by shifting beliefs about tobacco use, preventing initiation, and reducing progression to established smoking.^{3–7} This empirical body of evidence from 2 decades of research have yielded guidance on identifying promising message

strategies, developing advertisements that resonate with youth, and purchasing media to achieve sufficient campaign exposure within the intended audience.^{8,9} Today,

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media campaigns occur in a rapidly evolving media environment, requiring specialized audience targeting of advertisements to engage youth across multiple media channels. The extent to which current media campaigns successfully influence youth may differ from past generations of health campaigns,¹⁰ and continued research on the effectiveness of education campaigns is critical to ensure they positively impact public health.

The Real Cost is a national public education campaign designed to prevent and reduce smoking among U.S. teenagers. The theme of the campaign—every cigarette costs you something—is conveyed through advertisements that highlight the health effects, toxicity, and loss of control associated with smoking.¹¹ Sponsored by the U.S. Food and Drug Administration's Center for Tobacco Products, *The Real Cost* is grounded in scientific evidence and behavior change theory.^{8,9,12}

Advertisements have aired continuously at high media levels since the launch of *The Real Cost* in February 2014, resulting in high levels of campaign recall¹³ and changes in tobacco-related beliefs nationwide.¹⁴ A previous study found a positive dose–response relationship between youths' self-reported recall of *The Real Cost* advertisements and lower rates of smoking initiation.¹⁵ However, self-reported exposure data are subject to measurement error. Using an exogenous measure of media dose, such as market-level target rating points (TRPs), is the most rigorous approach in natural experiments like media campaigns when control groups are unfeasible.^{16–18} More broadly, the triangulation of findings regarding campaign effects using complementary exposure assessments is important in a complex media environment that includes multiple public tobacco-related campaigns and media channels.

This study is the first in a decade to assess a national youth media campaign's multi-year impact on smoking initiation using market-level exposure to TV and online advertisements. Data from a national cohort of youth were examined to explore the association between temporal and geographic variation in campaign exposure and initiation among youths between 2014 and 2016. Data from 5 waves of a longitudinal survey of U.S. youth were analyzed to determine whether campaign exposure influenced trial of cigarette smoking over 3 years among never smokers at baseline.

METHODS

Study Sample

Data were from a nationally representative longitudinal survey of U.S. youths aged 11–16 years at baseline. An address-based sampling frame, supplemented with market research data, was used to randomly draw households likely to have at least 1 eligible

youth (5% of households) in U.S. Census block groups within 75 media markets. In person baseline data collection took place from November 11, 2013, through March 31, 2014. Four subsequent surveys were collected during the following time periods either online or in person: first follow-up, July 24–October 27, 2014; second follow-up, April 6–July 4, 2015; third follow-up, December 17, 2015–April 5, 2016; and fourth follow-up, September 15–November 22, 2016. Participants received \$25 for survey completion in the first 3 weeks and \$20 thereafter. The baseline sample size was 6,743 youths; 4,210 youths completed all follow-up waves. The analytic sample included 5,103 youths who were nonsmokers at baseline and completed at least 1 follow-up wave. The study was approved by IRBs at the Food and Drug Administration and the researching institution.

At baseline, 7,418 sampled households were eligible to participate; 2,083 households with unknown eligibility were estimated to be eligible. Participants in 4,538 households completed a survey. The unweighted household-level response rate was 47.8%, and the weighted household-level response rate was 43.7% at baseline.¹⁹ The person-level response rates for the 4 follow-ups, calculated as the percentage of the sample from the previous study wave, ranged from 84.9% to 91.4%.

The Real Cost was designed to encourage teens to reassess the costs of tobacco use. Advertising in the first year focused on short-term health effects and loss of control associated with smoking. Advertising in 2015 and 2016 continued these themes and introduced new messages about the toxic chemicals in cigarettes and health consequences using a humorous approach ([Appendix Table 1](#), available online). Advertisements aired on national TV, radio, the Internet, out-of-home displays, in magazines, and at movie theaters. Campaign messages were also disseminated through social media and mobile gaming.

The standard unit of measurement for media delivery,^{17,20} TRPs are calculated as the product of 2 measures, the percentage of a target population potentially exposed to advertisements (reach) and the average number of times advertisements may have been seen (frequency) over a time period. Youth in the study markets were exposed to the following mean values of cumulative TV TRPs and digital video TRPs, respectively: 2,451 and 609 (baseline to first follow-up), 2,976 and 937 (first to second follow-up), 2,768 and 1,012 (second to third follow-up), and 2,775 and 1,372 (third to fourth follow-up). The average weekly TV TRPs were 63 (range, 22–150); the average digital video TRPs were 22 (range, 10–50).

Measures

The primary outcome of interest was smoking initiation among youths who had never smoked at the time of the baseline survey (never smokers). Smoking initiation was defined as first trial of a cigarette among youths who had never used cigarettes.

Two TRP measures that combine TV and digital video TRPs were calculated for each respondent based on the designated market area where the individual lived and the timing of the respondent's surveys. Because media may take considerable time to influence smoking behavior, TRPs from the campaign launch through the date a respondent took each respective survey were aggregated. However, cumulative TRPs monotonically increase with a time trend during the study period. An alternative exposure specification shortens the timeframe over which TRPs are studied

to between each survey wave. Between-wave TRPs limit the media's measurable effect because older TRP exposures that may have reasonably affected future smoking initiation are excluded. However, it reduces the inherent association between TRPs and time in the cumulative measure.

After viewing each advertisement, respondents also reported their frequency of exposure to each of 4 to 6 advertisements²¹ on air: *Apart from this survey, how frequently have you seen these ads in the past (insert) months?* Scores for responses ranged from 0 (*never*) to 4 (*very often*). Scores across all ads were summed, resulting in a range as follows: 0–16 (first, second, and fourth follow-ups) and 0–24 (third follow-up). Overall, 6% of the sample (3%–10% by wave) reported never seeing any of the ads. A dichotomous measure from the full range of responses for the lowest 15% of scores (low or no exposure, score <4) and all others (high exposure, score >4) was created.

Models controlled for factors that influence susceptibility to tobacco use and risky behaviors.²² A brief scale assessed sensation seeking²³ (Cronbach's $\alpha=0.74$): *I would like to explore strange places; I like to do frightening things; I like new and exciting experiences, even if I have to break the rules; and I prefer friends who are exciting and unpredictable.* Scores for response options ranged from 1 (*disagree strongly*) to 5 (*agree strongly*). Educational plans were assessed as: *How far do you think you will go in school?* Scores for response options ranged from 1 (*I don't plan to go to school anymore*) to 8 (*graduate, medical, or law school*). School environment was measured as the mean of 3 items ($\alpha=0.79$): *I feel close to people at my school; I am happy to be at my school; and I feel like I am a part of my school.* Scores for response options ranged from 1 (*disagree strongly*) to 5 (*agree strongly*). School performance was assessed with the item: *How well would you say you have done in school?* Scores for response options ranged from 1 (*much worse than average*) to 5 (*much better than average*). Parent communication was a mean of 2 items ($\alpha=0.69$). The first was: *Thinking about the adult or adults you live with, would you say you are satisfied with the way you communicate with each other?* Scores for responses ranged from 1 (*very unsatisfied*) to 5 (*very satisfied*). The second item was: *How close do you feel to the adult or adults you live with?* Scores for responses ranged from 1 (*not close at all*) to 5 (*very close*).

Self-reported awareness of 2 other national campaigns were assessed. For truth, youth viewed a collage of ad screenshots and were asked: *Apart from this survey, how frequently have you seen these ads in the past (insert) months?* Scores for response options ranged from 0 (*never*) to 4 (*very often*). At first follow-up, the item: *In the past 3 months, have you seen or heard the following slogan or theme Tips from Former Smokers? (yes/no)* was assessed. For all other waves, *Tips* was assessed using a collage of screenshots and the exposure item described above. A wave-specific measure was generated as 0 or 1 (first follow-up) and 0 or 1 (never or rarely, or greater for the other waves). Media use was assessed as daily hours watching TV or movies across 4 media devices: live or streaming TV, computers/laptops/tablets, cell phones, and other personal electronics; scores for response options for each device ranged from 0 (*none*) to 4 (*>3 hours*). Responses were summed (range, 0–16).

Baseline individual characteristics included indicators for age; an indicator for female (male excluded as the reference); indicators for African-American, Hispanic, and other non-Hispanic race/ethnicity (white excluded as the reference); youth weekly

income (continuous); and the presence of a tobacco user in the household. The number of days between survey waves by individual (continuous, scaled by 30 days) and a secular time trend (categorical) were included, as well as state adult smoking prevalence from the 2013 Behavioral Risk Factor Surveillance System (1 unit increase = 1 percentage point) and 3 media market variables: median population size (in tens of thousands), median income (in tens of thousands of dollars), and media market education level (the proportion with bachelor's degree or higher). Baseline data collection occurred after campaign launch (range, 1–48 days) for 21.8% of the sample; a post-campaign indicator was included.

Statistical Analysis

Data on awareness of campaign advertisements were summarized. Attrition analyses between baseline and follow-up were conducted using chi-square significance tests. Discrete-time survival models^{24,25} were estimated using logistic regression with age as the time variable. Models controlled for confounding influences, similar to other longitudinal media studies.^{15,18,20,26} The risk for smoking initiation for each youth in the sample who reported never smoking at baseline was assessed as they aged during the study period. Once the event of interest (smoking initiation) occurred, the youth was dropped from subsequent time periods and the probability that a youth-initiated smoking at each age was calculated. The model included 13,970 observations from the analytic sample (N=5,103 youths). Smoking initiation over time was examined as a function of cumulative TRPs, between-wave TRPs, and self-reported frequency of exposure. TRPs were rescaled to yield ORs for the increased odds of each outcome given a unit increase of 3,500 total TRPs in each media market. This scaling unit represents the approximate size of the market-level media buy for *The Real Cost* between each survey. Analyses were conducted using unweighted data after performing a test to determine the impact of the weights on the analysis and variance.²⁷

The estimated number of youths prevented from initiating smoking was calculated using the difference between the predicted risk for initiation by age for each exposure model (Table 2) and the predicted risk for initiation by age in a hypothetical scenario where exposure to the campaign is either 0 (TRPs) or low (self-reported frequency). The difference in initiation rates was then applied to the national population of nonsmoking youth at each age (2010 Census), and the resulting estimated numbers of youths potentially prevented from initiating smoking at each age were summed.

Sensitivity analyses were conducted to examine the influence of e-cigarettes and other tobacco products on smoking initiation. An additional model examined the relationship between campaign exposure and using marijuana, a risky behavior unrelated to campaign messaging, to ascertain whether campaign effects were specific to smoking behaviors or a general association between exposure and risky behaviors. Other alternate specifications were examined but not reported as they did not meaningfully alter model results: functional forms of the TRP variable (e.g., square root or parabolic), disaggregated measures of TV and online TRPs, media market-level clustering and fixed effects, and the inclusion of covariates with relatively higher missingness. All analyses were conducted with Stata, version 14.0 in 2018.

RESULTS

Table 1 displays the unweighted demographic characteristics of the analytic sample. The sample did not include 492 youths who had tried smoking at baseline, 130 youths who were missing data on smoking status, or 1,017 youths who did not complete at least 1 follow-up survey. At baseline, nonsmoking youth respondents were evenly distributed across ages 11–16 years. The sample was evenly divided by sex and was 52.7% white non-Hispanic, 28.4% Hispanic, 8.6% black non-Hispanic, and 10.3% other non-Hispanic race/ethnicities or multiracial youth. Approximately one quarter of youth reported living with a tobacco user.

An analysis of sample attrition from baseline to fourth follow-up for the full study sample found that the unweighted samples were similar across sex. As a percentage of the total sample, the fourth follow-up sample

Table 1. Demographic Characteristics of *The Real Cost* Analytic Sample

Characteristic	Baseline n (%)
Age, years	
11	788 (15.4)
12	906 (17.8)
13	870 (17.1)
14	915 (17.9)
15	881 (17.3)
16	744 (14.6)
Sex	
Female	2,723 (53.4)
Male	2,381 (46.7)
Race/ethnicity	
White, non-Hispanic	2,690 (52.7)
Black, non-Hispanic	441 (8.6)
Hispanic	1,450 (28.4)
Other, non-Hispanic	523 (10.3)
Household tobacco use	
Yes	1,321 (25.9)
No	3,782 (74.1)
Smoking status	
Nonsusceptible nonsmoker	3,717 (72.8)
Susceptible nonsmoker	1,387 (27.2)
Census region	
Northeast	648 (12.7)
Midwest	1,008 (19.8)
South	1,774 (34.8)
West	1,674 (32.8)

Note: The analytic sample does not include $n=1,017$ youth from baseline who did not complete a follow-up survey. The sample also does not include $n=492$ youth who had already tried smoking at baseline and $n=130$ youth who were missing data on their smoking status at either baseline or wave 1.

contained slightly fewer black non-Hispanic youths, fewer youths who reported living with a tobacco user, fewer experimenters, and fewer youths who were aged 15–16 years at baseline. All differences were small; the mean absolute value of difference across comparisons was 1.7% (Appendix Table 2, available online).

Youth recall of 1 or more *The Real Cost* advertisements among the analytic sample was 89.9% (first follow-up), 95.4% (second follow-up), 96.8% (third follow-up), and 95.5% (fourth follow-up). Rates of smoking initiation in the 4 follow-up surveys were 4.5%, 3.9%, 4.4%, and 5.1%, respectively.

Table 2 displays data from the survival model on the hazard of initiation for between-wave TRPs, cumulative TRPs, and self-reported campaign exposure. All 3 measures of campaign exposure were associated with decreased risk of smoking initiation, between-wave TRPs (AOR=0.69, $p<0.01$), cumulative TRPs (AOR=0.89, $p<0.05$), and self-reported campaign exposure (AOR=0.73, $p<0.01$). For every 3,500 between-wave TRPs on air, there was an associated 31% reduction in the hazard of smoking initiation among youths. These findings were robust to alternate model specifications, including the inclusion of e-cigarette use and other tobacco product use as time-varying control variables (Appendix Table 3, available online). Models examining youth marijuana initiation found no relationship between levels of campaign exposure and initiation over time (Appendix Table 4, available online).

Figure 1 illustrates the influence of the campaign on smoking initiation estimated from the 3 exposure models. The hazard of smoking by age was plotted in the study scenario and for an alternate scenario where *The Real Cost* media does was either 0 (TRP models) or low (self-reported exposure models). The campaign was associated with an estimated 380,446 and 587,515 fewer youths initiating smoking between ages 11 and 19 years over the study period.

DISCUSSION

This nonexperimental longitudinal study is the first in a decade to demonstrate the behavioral effects of a youth-specific national media campaign using both exogenous market- and individual-level measures of exposure. Exposure to *The Real Cost* was associated with preventing approximately 380,000–587,000 U.S. youths aged 11–19 years from initiating smoking from February 2014 to November 2016. Patterns of e-cigarette use and other tobacco product use over the study period are not an explanation of the study results. Campaign exposure was associated with smoking initiation specifically,

Table 2. Results of a Discrete-Time Survival Model for Exposure and Smoking Initiation—U.S., 2014–2016

Explanatory variable ^a	Between-wave TRPs OR (95% CI)	Cumulative TRPs OR (95% CI)	Self-reported exposure OR (95% CI)
Exposure variable	0.69** (0.53, 0.90)	0.89* (0.79, 0.99)	0.73** (0.57, 0.92)
Age, years			
11	ref	ref	ref
12	0.82 (0.23, 2.96)	0.81 (0.22, 2.91)	0.74 (0.20, 2.71)
13	2.32 (0.71, 7.57)	2.30 (0.71, 7.50)	2.27 (0.69, 7.40)
14	3.40* (1.06, 10.94)	3.37* (1.05, 10.84)	3.40* (1.05, 10.96)
15	4.03* (1.26, 12.93)	4.00* (1.25, 12.82)	4.03* (1.25, 12.95)
16	4.34* (1.35, 13.91)	4.30* (1.34, 13.78)	4.27* (1.33, 13.72)
17	4.27* (1.32, 13.79)	4.21* (1.30, 13.59)	4.23* (1.31, 13.68)
18	6.44** (1.96, 21.15)	6.33** (1.93, 20.78)	6.27** (1.91, 20.64)
19	11.39*** (3.26, 39.86)	11.25*** (3.22, 39.34)	11.10*** (3.17, 38.88)
Sex			
Female	ref	ref	ref
Male	1.09 (0.93, 1.29)	1.10 (0.93, 1.29)	1.09 (0.93, 1.28)
Race			
White, non-Hispanic	ref	ref	ref
Black, non-Hispanic	1.17 (0.87, 1.56)	1.16 (0.87, 1.55)	1.14 (0.85, 1.53)
Hispanic	1.32** (1.08, 1.61)	1.32** (1.09, 1.61)	1.33** (1.09, 1.62)
Other, non-Hispanic	0.82 (0.61, 1.11)	0.82 (0.61, 1.10)	0.82 (0.61, 1.11)
Other covariates			
Youth allowance	1.03 (1.00, 1.07)	1.03 (1.00, 1.07)	1.03 (0.99, 1.07)
Lives with a tobacco user	1.77*** (1.50, 2.08)	1.77*** (1.50, 2.08)	1.74*** (1.48, 2.06)
Sensation seeking scale	1.49*** (1.35, 1.64)	1.48*** (1.34, 1.64)	1.49*** (1.35, 1.65)
School environment	0.84*** (0.77, 0.92)	0.84*** (0.77, 0.92)	0.84*** (0.77, 0.92)
School performance	0.81*** (0.73, 0.89)	0.81*** (0.73, 0.89)	0.81*** (0.73, 0.89)
School plans	0.92* (0.85, 0.99)	0.92* (0.85, 0.99)	0.92* (0.85, 1.00)
Parental communication	0.88** (0.80, 0.97)	0.88** (0.80, 0.97)	0.88** (0.80, 0.97)
Media use	1.03** (1.01, 1.05)	1.03** (1.01, 1.05)	1.03** (1.01, 1.05)
Wave			
1	ref	ref	ref
2	0.66*** (0.52, 0.84)	0.72* (0.55, 0.94)	0.62*** (0.49, 0.78)
3	0.51*** (0.39, 0.67)	0.65* (0.45, 0.93)	0.50*** (0.38, 0.66)
4	0.60*** (0.46, 0.80)	0.82 (0.51, 1.31)	0.54*** (0.41, 0.72)
Time between waves	1.13** (1.04, 1.23)	1.09* (1.01, 1.18)	1.09* (1.01, 1.18)

Note: Boldface indicates statistical significance (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$).

^aAdditional control variables include average market-level family income, average market-level high school completion rates, market population, 2013 Behavioral Risk Factor Surveillance System state smoking prevalence, measures of self-reported exposure to the *Tips From Former Smokers* and the Truth Initiative's truth[®] campaigns, an indicator for whether the youth's baseline interview was conducted after the launch of *The Real Cost*. TRP, target rating point.

rather than a general pattern of associations between risk behaviors and campaign media delivery.

These data add to the body of research demonstrating that state and national tobacco education campaigns are effective. This study supports the conclusions of other effective campaigns,^{17,18} specifically that high levels of extended advertising are required for media campaigns to achieve sustainable population changes in smoking behavior. Demonstrating the effects of digital and TV media on population-level behavior for youth requires longitudinal studies with sufficient sample sizes, which

can be costly. However, the findings add uniquely strong evidence to the knowledge base for the study of public health campaigns in real-world settings.

Limitations

This study has several limitations. First, sample attrition over time may have resulted in biases. Overall, there were few differences between youths in the completed sample and those missing at follow-up. However, youths in the sample who had experimented with cigarettes at baseline were more likely to drop out at follow-up; thus,

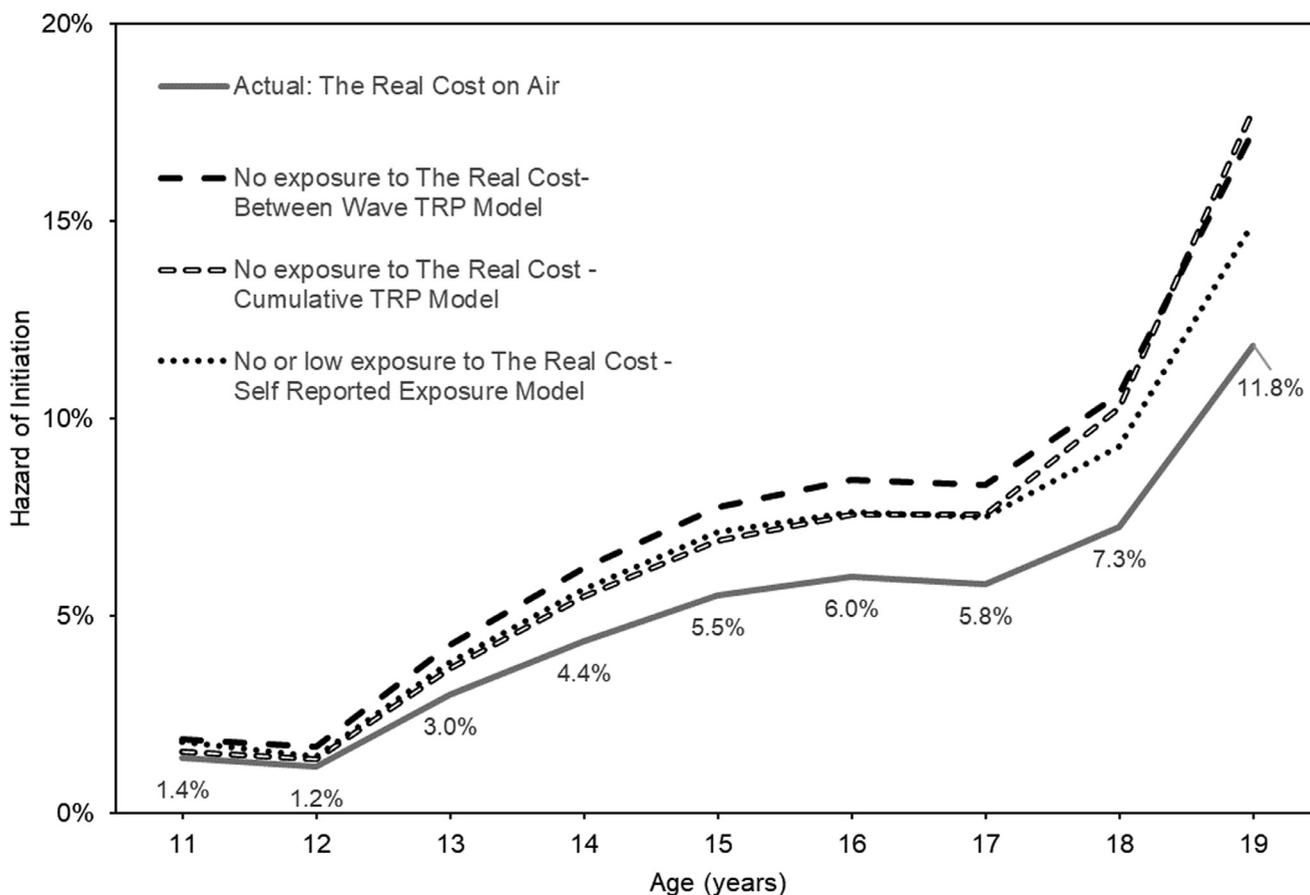


Figure 1. Estimated smoking initiation risk among youths aged 11–19 years, by age—U.S., 2014–2016. TRP, target rating point.

there may be bias in the analytic sample because of reduced completion rates among youths who experimented with cigarettes between study waves. Second, although the model controls for youths' exposure to other tobacco-related media campaigns, this might not fully account for the independent or synergistic effects of the other campaigns. Third, owing to the current measurement limitations in digital advertising, digital TRPs in the study did not vary greatly, so differentiating the independent effect of digital advertising was not possible. Fourth, only smoking initiation was examined in this study; data on progression to established or daily smoking were limited by sample size. Relatedly, this campaign examines initiation over a 2-year period, and longer studies are required to determine whether the campaign effectively delayed smoking initiation or led to sustained abstinence among this cohort.

CONCLUSIONS

Youths are at their highest lifetime risk for smoking initiation during adolescence²² and young adulthood. Media campaigns like *The Real Cost*, in combination

with other comprehensive tobacco control efforts, contribute to reductions in smoking uptake among youths nationwide, reducing future rates of cardiovascular disease, respiratory disease, cancer, and other deadly tobacco-related diseases.^{9,22} A tobacco-free cohort today would reduce future smoking-attributable mortality, healthcare costs, and lost workplace productivity.^{28–30} Continued efforts to prevent youths from becoming addicted to tobacco products will reduce greatly the public health burden of cigarette smoking in the U.S.

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SUPPLEMENTAL MATERIAL

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