

# Impact of the Tips From Former Smokers Anti-Smoking Media Campaign on Youth Smoking Behaviors and Anti-Tobacco Attitudes

Elizabeth Slocum PhD<sup>1</sup>, Yanmei Xie PhD<sup>1</sup>, David C. Colston MPH<sup>1,2</sup>, Sherry Emery PhD<sup>3</sup>, Megan E. Patrick PhD<sup>4</sup>, James F. Thrasher PhD<sup>5</sup>, Michael R. Elliott PhD<sup>6,4</sup>, Nancy L. Fleischer PhD<sup>1</sup>

<sup>1</sup>Department of Epidemiology, Center for Social Epidemiology and Population Health, School of Public Health, University of Michigan, 1415 Washington Heights Ann Arbor, MI 48109, USA

<sup>2</sup>Department of Health Behavior, Gillings School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599, USA

<sup>3</sup>Social Data Collaboratory, NORC at the University of Chicago, Chicago, IL 60603, USA

<sup>4</sup>Survey Research Center, Institute for Social Research, University of Michigan, Ann Arbor, MI 48104, USA

<sup>5</sup>Department of Health Promotion, Education, and Behavior, Arnold School of Public Health, University of South Carolina, Columbia, SC 29208, USA

<sup>6</sup>Department of Biostatistics, University of Michigan School of Public Health, Washington Heights Ann Arbor, MI 48109, USA

Corresponding Author: Elizabeth Slocum, PhD, *Department of Epidemiology, Center for Social Epidemiology and Population Health, School of Public Health, University of Michigan, 1415 Washington Heights Ann Arbor, MI 48109, USA. E-mail: emslocum@umich.edu*

## Abstract

**Introduction:** Anti-tobacco media campaigns can prevent youth smoking, but there is little research on how adult-targeted campaigns affect youth. We investigated the association between the Tips From Former Smokers (Tips) campaign and youth smoking behaviors and anti-tobacco attitudes, and variation by sex, race and/or ethnicity, or socioeconomic status.

**Aims and Methods:** We used data from the monitoring of the future study, a nationally representative survey on 8th, 10th, and 12th graders, from 2013–2015. Quartiles of Tips gross rating points (GRPs) were used to estimate exposure. Youth smoking behavior outcomes included smoking prevalence, initiation, and susceptibility. The anti-tobacco attitude outcomes included the extent that anti-tobacco ads made participants (1) less favorable towards smoking or (2) less likely to smoke cigarettes. Modified Poisson regression models estimated average marginal effects; separate additive interactions between Tips GRP exposure and sex, race and/or ethnicity, parents' highest education, and college plans (12th graders only) were used to test for effect modification.

**Results:** Tips GRPs were not associated with smoking behaviors within any grade. However, 12th graders in the highest quartile of Tips had a 7.0 percentage point higher probability (95% CI = 0.023–0.116) of responding that anti-tobacco ads made them less likely to smoke. Tips GRPs were associated with a lower probability of past 30-day smoking prevalence among 10th grade females, but not males (joint *P*-value = .002). No additional statistically significant interactions were found for any other outcomes for any grade.

**Conclusions:** This study revealed the potential for adult-targeted campaigns to increase youth's anti-smoking attitudes, but campaign exposure was not associated with smoking behaviors.

**Implications:** Few studies have examined the potential for anti-smoking media campaigns to influence audiences outside their targeted audience. In this study, we show the potential for adult-targeted campaigns to impact youth and suggest that Tips exposure may promote anti-smoking attitudes among youth.

## Introduction

Most people who smoke cigarettes initiate use prior to the age of 18 years, and, as such, broad reaching interventions that target youth smoking may be more impactful at reducing the overall rate of smoking in the population.<sup>1,2</sup> Youth-targeted anti-tobacco media campaigns such as The Real Cost, Truth, and other state sponsored anti-tobacco media campaigns have been effective at reducing youth smoking behaviors, while also increasing awareness of the negative effects of tobacco use.<sup>3–6</sup> Similarly, these same media campaigns have been effective at promoting anti-tobacco attitudes,<sup>7–9</sup> which is linked to reduced smoking susceptibility and initiation.<sup>10,11</sup>

Furthermore, some studies have shown that campaign effectiveness may vary across grade, sex, race and/or ethnicity, or socioeconomic status (SES) and may ultimately be effective at reducing youth smoking disparities.<sup>12–14</sup>

Media campaigns can also influence nontargeted audiences, such as the influence of adult-targeted anti-tobacco media campaigns on youth smoking behaviors.<sup>15–18</sup> A study on adolescents' perceptions of the adult-targeted Australian National Tobacco Campaign showed that 85% of adolescents found the campaign relevant to themselves, and 53% of those who smoked indicated that the campaign motivated them to quit smoking.<sup>17</sup> Furthermore, multiple studies in

Received: March 10, 2022. Revised: June 3, 2022. Accepted: June 22 2022.

© The Author(s) 2022. Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco. All rights reserved. For permissions, please e-mail: [journals.permissions@oup.com](mailto:journals.permissions@oup.com).

the United States, Australia, and Britain have reported that adolescents have a higher aided recall of adult-targeted media campaigns<sup>15,18</sup> and were more likely to remember and highly rate adult-targeted anti-tobacco media campaigns<sup>16</sup> compared to even some youth-targeted media campaigns. In particular, one study found that advertisements that employ emotional, graphic, or visceral themes and the use of messaging related to the lifelong effects of tobacco use had the greatest impact on youth recall and approval.<sup>16,19,20</sup> Taken together, these studies suggest that adult-directed anti-tobacco media campaigns may influence youth as a secondary audience. However, the majority of the studies described above did not explore the association between exposure to adult-targeted anti-tobacco media campaigns and youth smoking behaviors.

One particular adult-targeted anti-tobacco media campaign that may have a potential impact on youth smoking is the Centers for Disease Control and Prevention's (CDC) Tips from Former Smokers media campaign (Tips).<sup>18,21</sup> Tips uses first-person narratives of the permanent, debilitating health consequences of smoking to promote cessation and has been deemed highly successful in evaluation studies.<sup>22,23</sup> In its first year, Tips was estimated to have reached 78% of adults who smoked and 74% of adults who did not smoke,<sup>24</sup> and is attributed with at least 1.6 million quit attempts, 100 000 permanent quits,<sup>24</sup> and increased knowledge of tobacco-related health conditions.<sup>25,26</sup> However, evidence of how the association between Tips and tobacco use varies across relevant sociodemographic characteristics, such as sex, race and/or ethnicity, or socioeconomic status (SES), are either lacking or inconsistent.<sup>23,27,28</sup>

Despite extensive research highlighting that youth are exposed to Tips media campaigns,<sup>15,18</sup> there is less evidence on its association with youth smoking behaviors. However, one such study showed that aided recall of Tips advertisements was associated with increased quit intentions and lower susceptibility to smoking among adolescents.<sup>21</sup> Given Tips' visceral themes and widespread reach,<sup>22</sup> there is potential for the positive impacts of Tips exposure on smoking behaviors to extend beyond their targeted audience of adults to youth.

In the current study, we used Monitoring the Future (MTF),<sup>29</sup> a nationally representative sample of youth from 2013–2015, to assess associations between Tips media campaign and youth smoking behaviors and anti-tobacco attitudes. Second, we tested for effect modification of these associations by sex, race and/or ethnicity, and SES. This study can help elucidate the potential impact of adult-targeted campaigns in reducing smoking behaviors and related disparities among youth.

## Methods

### Sample

The MTF study is a nationally representative survey of 8th, 10th and 12th graders in the United States.<sup>29</sup> We utilized repeated cross-sectional data from 2013–2015. Because questions vary across subsets of randomly distributed survey forms, specific analytic samples for each grade and outcome vary and are reported for each analysis.

### Youth Smoking Behavior Outcomes

We examined four smoking behavior outcomes: past 30-day smoking prevalence, smoking susceptibility, first cigarette initiation, and daily smoking initiation. We examined past 30-day smoking prevalence (defined as yes or no) among

all respondents. Smoking susceptibility (defined as intent to smoke in the next 5 years versus definitely will not smoke) was measured among respondents who never smoked. First smoking initiation (defined as yes or no) was measured among respondents who never smoked prior to their current grade. Respondents were asked “when did you smoke your first cigarette?” and answered never or the grade when they initiated their first cigarette smoking. Among respondents who had never smoked daily prior to their current grade, daily smoking initiation (defined as yes or no) was examined. Respondents were asked “when did you smoke cigarettes on a daily basis?” and answered never or the grade when they initiated daily smoking.

### Anti-tobacco Attitude Outcomes

In addition to smoking behavior outcomes, we also assessed two relevant anti-tobacco attitude outcomes. A subset of participants were randomly assigned to data collection forms with these two questions: “To what extent do you think such (anti-tobacco) ads on TV, radio, and billboards or in magazines and newspapers have made you less favorable toward smoking cigarettes?” and “To what extent do you think such (anti-tobacco) ads on TV, radio, and billboards or in magazines and newspapers have made you less likely to smoke cigarettes?” Responses included “not at all,” “to a little extent,” “to some extent,” “to a great extent,” or “to a very great extent.” Both variables were dichotomized as some/great/very great extent versus not at all/to a little extent.

### Media Exposure

Tips media campaign exposure was measured using gross ratings points (GRPs) for the top 75 designated market areas (DMAs). DMAs are divisions of counties used by Nielsen Media Research to estimate household television ratings, and the top 75 are determined based on the number of households with televisions per DMA.<sup>30</sup> The MTF sample used is limited to respondents in these top 75 DMAs (78.6% of 8th graders, 83.3% of 10th graders, and 79.8% of 12th graders were in the top 75 DMAs). GRPs are calculated as the percentage of the target audience reached by the campaign multiplied by the average number of exposures and represent the total ad campaign volume to a target audience. GRP measures were divided by 100 to create an exposure measure representative of average views per person.<sup>31</sup> We generated both a 4-month depreciated sum and a 12-month non-depreciated sum of Tips campaign exposures<sup>32</sup> and merged them to survey data using the respondents' school county and month and year of survey completion. We used a quartile form of the 4-month depreciated sum exposure to understand the impact of the exposure on shorter-term outcomes, such as smoking susceptibility in the next 5 years, past 30-day smoking prevalence, and the attitude and belief outcomes. To allow for a longer timeframe of potential exposure for the smoking initiation outcomes, and because the outcomes are based on behavior in the current grade with survey data collected in the spring, we used a quartile form of the 12-month non-depreciated sum.<sup>31</sup> Depreciation calculations were consistent with the current literature base and depreciation values were set to 0.3.<sup>13,32</sup>

We used quartiles of GRPs due to the non-linear effects of campaign exposure on smoking outcomes. In previous analyses of the relationship between GRPs and smoking outcomes among youth, researchers found higher-order effects of continuous GRPs for past 30-day smoking prevalence and smoking susceptibility.<sup>33</sup> We also fitted higher-order

polynomial models for our GRP exposure, and found a quadratic association between continuous GRPs and smoking susceptibility among 12th graders. To keep the exposure consistent across all models and outcomes, we categorized GRPs into quartiles, making the results more interpretable. This approach has also been used in previous analyses.<sup>34</sup> Distributions of 4-month depreciated and 12-month non-depreciated Tips GRPs for each grade are shown in [Supplementary Appendix Figures 2–7](#). Quartiles of Tips GRPs were based on the entire study population.

### Covariates

We adjusted for various respondent-level sociodemographic factors: Sex (male or female), race and/or ethnicity (non-Hispanic (NH) white, NH black, Hispanic, NH Asian, or another race and/or ethnicity), highest educational attainment for either parent (less than high school or high school graduate, some college, or college graduate or higher), living arrangement (neither mother nor father in household, lives with mother, lives with father, lives with both parents), and high school program type (college prep; general; vocational or technical; other or don't know). Among 8th and 10th graders, the mother's employment status was defined as not employed, part time, or full time. Among 12th graders, the mother's employment status was defined as none, sometimes, most of the time, or all of the time. Among 12th graders only, college plans were defined as "definitely will," "probably will," and "probably" or "definitely would not" plan to attend college and used as proxy measures for SES.<sup>35,36</sup> Additionally, for the two anti-tobacco outcomes, we also adjusted for past 30-day smoking prevalence.

We also adjusted for several county-level sociodemographic variables (poverty rate, percent Hispanic population, percent black population, percent college graduates among the population age 25 years and older), state unemployment rate, average annual sale price per pack of 20 cigarettes (adjusted to the 2016 dollar values using the Gross Domestic Product Implicit Price Deflator<sup>37</sup>), Census region (Midwest, Northeast, South, West), and survey year. Percentage of the county population that was Hispanic and black, county poverty rate, and percent of the county college graduates among the population age 25 years and older were obtained from the US Census Bureau's American Community Survey (ACS).<sup>38</sup> The Tax Burden on Tobacco was used for obtaining cigarette pack sale prices.<sup>39</sup> For student respondents during the spring survey period, cigarette pack sale prices were averaged between adjacent years to account for cigarette prices potentially changing since last reported on November 1 of that year.<sup>40</sup>

### Statistical Analysis

Grade-stratified modified Poisson regression models<sup>41</sup> were used to examine the association between Tips exposure and each of the six outcomes described above. Among all grades, effect modification was assessed for each outcome using an interaction between Tips exposure and either sex, race and/or ethnicity, or parental education. Among 12th graders, we additionally tested for interaction between Tips exposure and college plans. Significance of each interaction was measured on the additive scale using average marginal effects (AME)<sup>42</sup> and adjusted for multiple testing using a false discovery rate of 5%.<sup>43</sup>

Analyses described in this study were performed using Stata version 15.0. The complex survey design of MTF was accounted for using strata, school cluster, and individual

sample weights<sup>44</sup> and empirical variance estimators were used to allow for overdispersion in Poisson regression models.

### Multiple Imputation

To adjust for missing values, data used for analysis were multiply imputed using sequential regression imputation under the assumption of missing at random.<sup>45</sup> Ten datasets were imputed separately by grade using imputation models including the covariates described in [Table 1](#). Additionally, imputation models also adjusted for age, hours worked per week, weekly earnings from a job, weekly earnings from allowances or other sources, ever smoked, grade of smoking a cigarette for the first time, grade of starting daily smoking,  $\geq 5$  drinks in a row in the last 2 weeks, marijuana use in the last 30 days, school type, anti-tobacco attitudes, and year of survey administration.

### Sensitivity Analyses

As sensitivity analyses, we reran all models using the complete case data. Additionally, we repeated analyses using weights that incorporated county-level clusters instead of school clusters.

## Results

### Demographics

Descriptive statistics for the 8th, 10th, and 12th graders in the past 30-day smoking prevalence sample for years 2013 to 2015 are provided in [Table 1](#). The smoking prevalence sample included 35 716 8th graders, 35 622 10th graders, and 31 869 12th graders ([Table 1](#)). The samples for the other smoking behavior outcomes and anti-tobacco attitude outcomes are subsets of the smoking prevalence samples; descriptive statistics, and sample sizes for the other outcomes can be found in [Supplementary Appendix Tables 1–4](#). The percentage of respondents who reported past 30-day smoking prevalence increased with grade (4.10%, 7.05%, 13.27% for 8th, 10th, and 12th graders, respectively, [Table 1](#)), as did the first cigarette initiation and daily smoking initiation ([Supplementary Appendix Tables 1–2](#)). Five-year smoking susceptibility and the two anti-tobacco attitude outcomes decreased with grade ([Supplementary Appendix Tables 3–4](#)). The categorical 4-month depreciated Tips GRPs exposure were evenly distributed across the three grades ([Table 1](#)). The same was true for the 5-year smoking susceptibility sample and the two anti-tobacco attitude samples ([Supplementary Appendix Tables 3–4](#)) and for the 12-month non-depreciated Tips GRPs exposure used for the first cigarette initiation and daily smoking initiation samples ([Supplementary Appendix Tables 1–2](#)).

The majority of the smoking prevalence sample were female and NHwhite ([Table 1](#)), consistent across all grades. For 8th and 10th grade participants in the sample, the majority of their mother's employment status was full-time and for 12th graders, the majority of their mothers were employed all of the time ([Table 1](#)). For all grades, the majority of the sample respondents lived with both parents ([Table 1](#)). For 12th graders, nearly 60% of respondents responded "yes, definitely" to their college plans ([Table 1](#)). The sociodemographic patterns of the past 30-day smoking prevalence sample were consistent with the additional smoking behavior outcomes ([Supplementary Appendix Tables 1–3](#)) and the anti-tobacco attitude outcomes ([Supplementary Appendix Table 4](#)).

**Table 1.** Weighted descriptive statistics for all 8th, 10th, and 12th graders in 30-day smoking prevalence sample, monitoring the future, 2013–2015. results shown are using imputed data ( $m = 10$ )

	Sample for 30-day smoking prevalence		
	Grade 8	Grade 10	Grade 12
Unweighted <i>N</i>	35 716	35 622	31 869%
Variables	Wt. %	Wt. %	Wt.
Past 30-day smoking prevalence			
Yes	4.10%	7.05%	13.27%
No	95.90%	92.95%	86.73%
Race/ethnicity			
non-Hispanic white	42.96%	53.81%	53.37%
non-Hispanic black	14.17%	12.26%	11.28%
Hispanic	24.57%	16.41%	19.19%
non-Hispanic Asian	4.69%	5.01%	4.40%
Another race/ethnicity	13.61%	12.52%	11.75%
Sex			
Female	48.81%	49.28%	49.48%
Male	51.19%	50.72%	50.52%
Education, parents' highest			
<=High school	28.65%	25.38%	28.71%
Some college	14.94%	15.96%	19.97%
College or greater	56.41%	58.66%	51.32%
4-month depreciated			
<25 percentile	20.23%	27.36%	26.03%
25–50 percentile	29.74%	25.28%	26.54%
50–75 percentile	27.25%	23.90%	20.98%
>75 percentile	22.78%	23.46%	26.45%
Living arrangement			
Neither mother or father in household	3.76%	3.81%	5.73%
Lives with father	3.52%	3.94%	5.26%
Lives with mother	20.08%	18.47%	22.33%
Lives with father and mother	72.64%	73.77%	66.68%
Employment, mother's current (grade 8/10)			
Not employed	22.01%	22.63%	—
Part time	19.00%	16.81%	—
Full time	59.00%	60.55%	—
Employment, mother's current (grade 12)			
None	—	—	14.27%
Sometimes	—	—	19.00%
Most of time	—	—	18.03%
All the time	—	—	48.70%
High school program			
College prep.	35.33%	47.38%	50.24%
General	17.25%	24.68%	35.69%
Vocational/technical	5.14%	4.07%	3.54%
Other/do not know	42.28%	23.87%	10.54%
Census region			
Northeast	18.61%	22.17%	19.45%
Midwest	21.42%	23.43%	22.29%
South	36.36%	29.01%	33.58%
West	23.62%	25.39%	24.68%
College plans (grade 12)			
No, probably/definitely	—	—	16.95%
Yes, probably	—	—	23.32%

Table 1. Continued

	Sample for 30-day smoking prevalence		
	Grade 8	Grade 10	Grade 12
Unweighted N	35 716	35 622	31 869%
Variables	Wt. %	Wt. %	Wt.
Yes, definitely	—	—	59.72%
State cigarette price (mean \$ (SD), range)	6.46 (1.44), 4.49–10.42	6.36 (1.35), 4.49–10.42	6.48 (1.48), 4.58–10.42
State unemployment (mean % (SD), range)	0.06 (0.01), 0.03–0.09	0.06 (0.01), 0.03–0.09	0.06 (0.01), 0.03–0.09
County poverty (mean % (SD), range)	0.15 (0.05), 0.05–0.38	0.15 (0.06), 0.04–0.37	0.15 (0.05), 0.04–0.31
County % black (mean % (SD), range)	0.12 (0.11), 0.00–0.63	0.13 (0.14), 0.00–0.59	0.11 (0.10), 0.00–0.48
County % Hispanic (mean % (SD), range)	0.19 (0.17), 0.00–0.66	0.16 (0.14), 0.00–0.57	0.20 (0.17), 0.00–0.66
County % college grad (age 25≥) (mean % (SD), range)	0.31 (0.10), 0.09–0.60	0.31 (0.11), 0.10–0.73	0.30 (0.10), 0.10–0.60

SD: standard deviation, wt: weighted.

### Main Effects Analysis: Youth Smoking Behaviors

We found no evidence of a statistically significant relationship between Tips GRPs and smoking susceptibility, past 30-day smoking, first cigarette initiation, or daily smoking initiation among 8th, 10th, or 12th graders in adjusted models (Table 2).

### Effect Modification Analysis by Sociodemographic Factors: Youth Smoking Behaviors

After adjusting for multiple testing, we found statistically significant interactions between Tips GRPs and sex among 10th graders only for past 30-day smoking prevalence (joint  $P$ -value: .002, Supplementary Appendix Table 5). Specifically, greater Tips GRPs were associated with a lower probability of smoking in the past 30 days among 10th grade females versus males (Figure 1). There was no evidence of any additional statistically significant interactions by sex, race and/or ethnicity, parental education, or plans to attend college and Tips GRPs for any other smoking behavior outcomes in any other grade (Supplementary Appendix Table 5).

### Main Effects Analysis: Anti-tobacco Attitudes

We found no association between Tips GRPs and reporting that anti-tobacco ads, in general, made respondents less likely to smoke a cigarette or less favorable towards smoking among 8th and 10th graders in adjusted models (Table 3).

Among 12th graders, we found that higher Tips GRP exposure was associated with a higher probability of responding that anti-tobacco ads, in general, made them less likely to smoke in the adjusted model (Table 3). Respondents in the 2nd, 3rd, and highest quartiles of GRPs had a 0.5, 2.4, and 7.0 percentage point increase, respectively, in the probability of responding that anti-tobacco ads, in general, made them less likely to smoke relative to respondents with GRP exposure below the 25th percentile (25th–50th percentile AME: 0.005, 95% CI: –0.042, 0.052; 50th–75th percentile AME: 0.024, 95% CI: –0.034, 0.082; 75th percentile AME: 0.070, 95% CI: 0.023, 0.116) (Table 3).

### Effect Modification Analysis by Sociodemographic Factors: Anti-tobacco Attitudes

We found no evidence of any statistically significant interactions by sex, race and/or ethnicity, parental education, or plans to

attend college and Tips GRPs for either of the anti-tobacco attitude outcomes among 8th, 10th, or 12th graders after adjusting for multiple testing (Supplementary Appendix Table 6).

### Sensitivity Analyses

We conducted two sensitivity analyses to compare results with the multiply imputed data described above: (1) repeating analyses using the complete case data, and (2) using county-level clustering instead of school clustering with multiply imputed data. Results using the complete case data and the county-level clusters were largely consistent with the main results with respect to both statistical significance and direction of effect (Supplementary Appendix Tables 7–20, Supplementary Appendix Figure 1). The only differences of note were that the joint  $P$ -value for the association between Tips GRPs exposure and smoking susceptibility among 12th graders when accounting for county-level clustering was statistically significant ( $P$ -value = .017) (Supplementary Appendix Table 17). However, the magnitude and direction of the trend remained consistent between the two results.

Additionally, we found a statistically significant interaction between race and/or ethnicity and Tips GRPs for the two anti-tobacco attitude outcomes, after adjusting for multiple testing, among 10th graders only in the complete case data (Supplementary Appendix Table 16), and found a statistically significant interaction between race and/or ethnicity and Tips GRPs among 10th graders for the less likely to smoke outcome when accounting for county-level clustering (Supplementary Appendix Table 20) after adjusting for multiple testing (Supplementary Appendix Table 20). In our main results, these interactions were statistically significant before adjusting for multiple testing, but not after (Supplementary Appendix Table 6).

## Discussion

### Summary of Findings

Using a nationally representative sample of 8th, 10th, and 12th graders in the United States, we examined the potential for the adult-targeted Tips media campaign to affect youth smoking behaviors and anti-tobacco attitudes. We found that among 12th graders only, Tips GRP exposure was positively associated with reporting that anti-tobacco ads, in general,

**Table 2.** Adjusted<sup>a</sup> Average Marginal Effects (AME) Change in Media Exposure (Tips) on Smoking Susceptibility, 30-day Smoking Prevalence, Daily Smoking Initiation, and First Cigarette Initiation, Monitoring the Future, 2013–2015. Results Shown are Using Imputed Data ( $m = 10$ )

	8th Graders		10th Graders		12th Graders	
	AME (95% CI)	P-value	AME (95% CI)	P-value	AME (95% CI)	P-value
Smoking susceptibility 5 yrs						
<i>4-month depreciated (vs. &lt; 25 percentile)</i>						
25–50 percentile	–0.005 (–0.043, 0.032)	.880	0.002 (–0.029, 0.033)	.476	–0.029 (–0.055, –0.003)	.105
50–75 percentile	–0.015 (–0.056, 0.026)		0.011 (–0.028, 0.050)		–0.024 (–0.056, 0.008)	
>75 percentile	–0.004 (–0.042, 0.033)		–0.015 (–0.047, 0.018)		–0.002 (–0.029, 0.025)	
N	10 352		9456		7208	
Smoking prevalence						
<i>4-month depreciated (vs. &lt; 25 percentile)</i>						
25–50 percentile	0.001 (–0.010, 0.012)	.741	0.007 (–0.008, 0.021)	.582	0.013 (–0.007, 0.032)	.103
50–75 percentile	0.006 (–0.007, 0.019)		0.000 (–0.015, 0.015)		0.023 (0.005, 0.041)	
>75 percentile	0.004 (–0.009, 0.016)		0.006 (–0.008, 0.019)		0.010 (–0.006, 0.026)	
N	35 716		35 622		31 869	
Daily smoking initiation						
<i>12-month non-depreciated (vs. &lt; 25 percentile)</i>						
25–50 percentile	0.000 (–0.006, 0.005)	.936	0.002 (–0.003, 0.007)	.793	–0.005 (–0.014, 0.004)	.506
50–75 percentile	–0.001 (–0.006, 0.003)		0.002 (–0.004, 0.007)		0.002 (–0.008, 0.012)	
>75 percentile	–0.001 (–0.006, 0.004)		–0.001 (–0.006, 0.005)		–0.001 (–0.013, 0.011)	
N	34 913		33 944		14 535	
First cigarette initiation						
<i>12-month non-depreciated (vs. &lt;25 percentile)</i>						
25–50 percentile	0.004 (–0.004, 0.012)	.654	0.001 (–0.009, 0.011)	.851	0.012 (–0.006, 0.029)	.225
50–75 percentile	0.000 (–0.009, 0.009)		–0.001 (–0.010, 0.008)		0.006 (–0.011, 0.024)	
>75 percentile	0.003 (–0.005, 0.011)		–0.003 (–0.013, 0.008)		–0.004 (–0.024, 0.016)	
N	31 728		28 931		11 245	

<sup>a</sup>AMEs are estimated using single models with Tips media campaign exposure as the independent variable and each outcome. Each model adjusted for sex, race/ethnicity, parents' highest education, college plans (12th graders only), living arrangement, mother's current employment, high school program, year, census region, state cigarette price, state unemployment, county poverty, county percent population Hispanic, county percent population black, and county percent college graduates

made them less likely to smoke. We found no association between Tips exposure and any smoking behaviors within any grades. We further examined if the associations between Tips exposure and smoking outcomes and anti-tobacco attitudes varied by sex, race and/or ethnicity, and SES, and found no evidence for effect modification, except by sex among 10th graders for smoking prevalence.

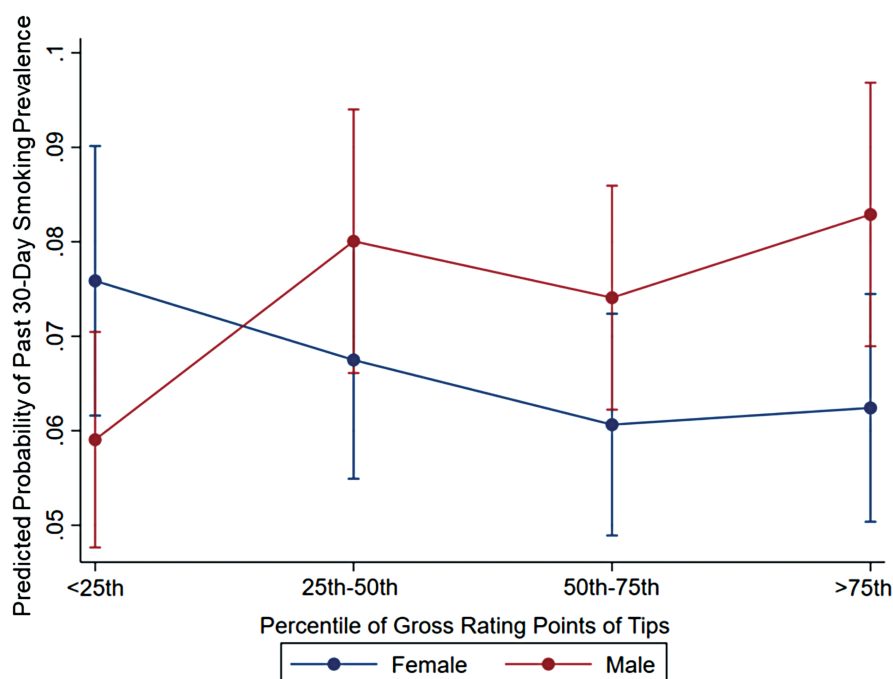
We found no statistically significant evidence that Tips campaign exposure was associated with a lower likelihood of smoking among youth. Several studies have previously shown that youth-targeted anti-tobacco media campaigns have been successful at reducing youth smoking prevalence<sup>3,5,33</sup>; however, the impact of Tips on youth smoking prevalence had not been evaluated prior to our study. This may be because of the emphasis by Tips on promoting smoking cessation and quit attempts<sup>23,24</sup> and therefore may have less of an impact on smoking prevalence compared to other media campaigns.

While the majority of Tips evaluation studies focus on assessing the impact on adult smoking cessation,<sup>23,24</sup> the campaign's depiction of the lifelong health consequences of smoking may also discourage nonsmokers from intending to or initiating smoking. However, in this study, we did not observe an impact on smoking susceptibility associated with Tips exposure. By contrast, a previous study showed an

association between Tips exposure and smoking susceptibility among youth, and found that exposure to four or more Tips ads was associated with lower odds of smoking susceptibility among adolescents, compared to unexposed youth.<sup>24</sup> However, this study used a more encompassing measure of susceptibility, ranging from “accept a cigarette offer from one of their best friends” to “smoke a cigarette in the next year,” compared to our study, which limited smoking susceptibility to just intent to smoke in the next 5 years. Therefore, the difference in measures of susceptibility may help explain the contradictory results.

We did not find evidence of a statistically significant association between Tips GRPs and first cigarette initiation or daily smoking initiation within any grade. One possible explanation for this is that people who do not smoke may be less likely to perceive anti-tobacco media campaigns as relevant and, therefore, less likely to attend to, or meaningfully engage, with the information from such campaigns.<sup>15,21,46</sup> As a result, youth who smoke appear more likely to recall anti-tobacco ads compared to youth who do not smoke.<sup>15</sup>

In contrast to our null findings regarding smoking behaviors, we found that among 12th graders, greater Tips GRP exposure was associated with reporting that anti-smoking campaigns, in general, increased their anti-tobacco



**Figure 1.** Differential association of anti-smoking media campaign exposure on 30-day smoking prevalence among 10th graders, by sex, monitoring the future, 2013–2015. Results shown are using imputed data ( $m = 10$ ) ( $n = 35\ 622$ ).

**Table 3.** Adjusted<sup>a</sup> Average Marginal Effects (AME) Change in Media Exposure (Tips) on a Less Favorable Attitude Towards Smoking Cigarettes and Less Likely to Smoking a Cigarette, Monitoring the Future, 2013–2015. Results Shown are Using Imputed Data ( $m = 10$ )

	8th graders		10th graders		12th graders	
	AME (95% CI)	P-value	AME (95% CI)	P-value	AME (95% CI)	P-value
Less favorable towards smoking cigarettes						
<i>4-month depreciated (vs. &lt;25 percentile)</i>						
25–50 percentile	-0.021 (-0.062, 0.021)	0.791	-0.010 (-0.041, 0.022)	0.815	0.020 (-0.028, 0.068)	0.060
50–75 percentile	-0.011 (-0.053, 0.030)		-0.018 (-0.055, 0.019)		0.036 (-0.024, 0.095)	
>75 percentile	-0.008 (-0.047, 0.032)		-0.007 (-0.037, 0.023)		0.062 (0.017, 0.107)	
N	11 905		11 898		5308	
Less likely to smoke a cigarette						
<i>4-month depreciated (vs. &lt;25 percentile)</i>						
25–50 percentile	-0.028 (-0.067, 0.012)	0.335	-0.025 (-0.056, 0.006)	0.341	0.005 (-0.042, 0.052)	0.015
50–75 percentile	-0.001 (-0.039, 0.037)		-0.029 (-0.066, 0.007)		0.024 (-0.034, 0.082)	
>75 percentile	0.001 (-0.038, 0.040)		-0.010 (-0.043, 0.022)		0.070 (0.023, 0.116)	
N	11 905		11 898		5308	

<sup>a</sup>AMEs are estimated using single models with Tips media campaign exposure as the independent variable and each outcome. Each model adjusted for sex, past 30-day smoking prevalence, race/ethnicity, parents’ highest education, college plans (12<sup>th</sup> graders only), living arrangement, mother’s current employment, high school program, year, census region, state cigarette price, state unemployment, county poverty, county percent population Hispanic, county percent population Black, and county percent college graduates.

attitudes. The association between Tips exposure and reporting that anti-tobacco ads, in general, made them less likely to smoke suggests that the Tips campaign may reduce smoking behaviors over time, as youth with stronger anti-tobacco attitudes are more likely to quit smoking and less likely to initiate smoking.<sup>10,11</sup> However, these measures assess a respondent’s perceived receptivity or openness to anti-tobacco campaigns, rather than directly measuring anti-tobacco attitudes. Therefore, these findings suggest that the Tips campaign may be effective at increasing openness to changing attitudes after exposure to anti-tobacco attitudes

among youth. This may in part be due to the use of first-person narratives and emphasis on adverse health effects depicted in Tips ads.

Several Tips evaluations have shown Tips’ success at increasing adults’ awareness of the health effects of smoking.<sup>4,25,26</sup> Our evidence of an increase in anti-tobacco attitudes associated with Tips exposure may result from increased awareness and salience of smoking-related harms. The increase in likelihood of anti-tobacco attitudes is important given that youth with anti-tobacco attitudes are more likely to quit smoking or less likely to begin smoking.<sup>10,11</sup>

Furthermore, among 10th graders, we found a statistically significant interaction between Tips and sex for past 30-day smoking prevalence, in which greater Tips exposure was associated with a lower probability of smoking prevalence among females, but not males. We found no statistically significant evidence of any additional interactions between sex and Tips exposure for any other outcomes. Among adult smokers exposed to Tips, we previously reported no effect modification by sex on smoking cessation.<sup>23</sup> However, one study investigating the association between Tips exposure and smoking susceptibility among adolescent experimenters found that males were less likely to continue smoking compared to females.<sup>21</sup> Another study found that adolescent female respondents were more likely to be exposed to Tips media campaign than adolescent male respondents, consistent with our findings.<sup>18</sup>

We found no evidence of effect modification by race and/or ethnicity for any of the smoking behavior outcomes or anti-tobacco attitude outcomes. This finding is consistent with a previous study evaluating the association between Tips exposure and smoking cessation among adult populations.<sup>23</sup> Similarly, studies evaluating the youth-targeted anti-tobacco "Truth" media campaign found a lack of evidence of effect modification by race and/or ethnicity among youth populations.<sup>14,33</sup> Regarding Tips, one study examining potential Tips exposure among adolescents did report that NH white adolescents had greater Tips exposure than Hispanic adolescents.<sup>18</sup> However, no previous studies have investigated the differential effect of Tips on youth smoking behavior or attitudes by race and/or ethnicity.

We found no evidence of effect modification by SES for youth smoking behavior or anti-tobacco attitudes. While this is consistent with our previous studies on Tips exposure and adult smoking cessation,<sup>23</sup> studies on the association between media campaign exposure and youth smoking by SES remain largely inconclusive with varying findings.<sup>6,12,14,47</sup> However, among youth, we previously showed that media campaign exposure had a greater effect on reducing youth smoking behaviors among youth of lower SES groups.<sup>33</sup> Furthermore, it has been reported that anti-tobacco ads invoking multiple negative emotions have a greater impact on increased quit attempts among youth in lower SES groups, highlighting the potential for different anti-tobacco media campaigns to affect those of varying SES groups differently.<sup>19</sup>

### Strengths

This study is one of the few studies investigating the impact of Tips exposure on youth smoking behaviors and anti-smoking attitudes. Second, this study is unique in its investigation of the potential for effect modification and how media campaigns may help reduce persistent smoking-relating disparities. The few studies that examine the potential for the impact of Tips on youth population are limited to only looking at recall or awareness of the campaign, rather than its impact on smoking behaviors. Furthermore, the use of GRPs to measure exposure rather than aided recall or awareness of Tips campaign may reduce potential recall bias.<sup>48</sup>

### Limitations

We used a repeated cross-sectional study design, which increases the likelihood of reverse causation bias and limits our ability to determine causation. The wording of our

anti-tobacco attitude measures asked respondents to report on campaign effects on their attitudes about and likelihood of smoking, for which recall bias may be an issue, though the influence of this potential bias on our results is unclear. While we are able to show the impact of an adult-target anti-tobacco television advertisement on youth smoking attitudes, it is important to note that cable television watching patterns have drastically changed over the last decade.<sup>49</sup> Therefore, it is vital to consider developing new messaging techniques and formats among anti-tobacco media campaigns to better reach youth audiences. Despite our ability to estimate how often Tips advertisements aired in a respondent's area, we are unable to accurately measure how often they saw the advertisement, potentially leading to overestimates of the exposure. Furthermore, our power to detect effect modification was limited to some degree to larger interactions, given sample size and the dichotomous outcomes. Additionally, because of insufficient information on other campaigns, we are unable to adjust for a respondent's exposure to other youth-focused campaigns to assess whether the effects observed are truly because of Tips exposure. However, because many youth media campaigns aired during this time frame have been shown to be successful, this may make it difficult to pick up on an added effect of Tips exposure. Finally, this study was unable to investigate the potential association between Tips campaign exposure and smoking cessation among youth due to a lack of sufficient sample size to assess quit attempts or smoking cessation over time.

### Conclusions

This study revealed an association between Tips campaign exposure and anti-tobacco attitudes among 12th graders in the United States, but did not find an association between youth smoking behaviors and Tips exposure for 8th, 10th, or 12th graders. We found evidence of an interaction between sex and Tips exposure on smoking prevalence among 10th graders, suggesting that Tips exposure may impact males and females differently. Taken together, these findings suggest that even adult-targeted anti-tobacco media campaigns may have an impact on youth as a secondary audience and helps us to understand its potential to reduce smoking-related disparities among youth. Given the primary goal of the Tips campaign is to promote quit attempts and smoking cessation, this warrants future studies investigating the impact of Tips campaign exposure on youth smoking cessation.

### Supplementary Material

A Contributorship Form detailing each author's specific involvement with this content, as well as any supplementary data, are available online at <https://academic.oup.com/ntr>.

### Funding

This research was supported by the National Cancer Institute of the National Institutes of Health (grant number R37CA214787, recipient: NLF) and the National Institute on Drug Abuse of the National Institutes of Health (grant number R01DA001411, recipient: MEP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.



## Declaration of Interests

The authors have no conflicts of interest to disclose.

## Data Availability

Restricted monitoring the future Project Data can be accessed at [www.icpsr.umich.edu](http://www.icpsr.umich.edu), though permission and approval are needed to access restricted data files. Code for the analysis is available upon request.

## References

- Lantz P, Jacobson P, Warner K, *et al.* Investing in youth tobacco control: a review of smoking prevention and control strategies. *Tob Control.* 2000;9(1):47–63.
- U.S. Department of Health and Human Services. *The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General.* Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014.
- Farrelly MC, Davis KC, Haviland ML, Messeri P, Heaton CG. Evidence of a dose-response relationship between “truth” antismoking ads and youth smoking prevalence. *Am J Public Health.* 2005;95(3):425–431.
- Huang LL, Lazard AJ, Pepper JK, *et al.* Impact of the real cost campaign on adolescents’ recall, attitudes, and risk perceptions about tobacco use: a national study. *Int J Environ Res Public Health.* 2017;14(1):42–53.
- Sly DF, Heald GR, Ray S. The Florida “truth” anti-tobacco media evaluation: design, first year results, and implications for planning future state media evaluations. *Tob Control.* 2001;10(1):9–15.
- Thrasher JF, Niederdeppe J, Farrelly MC, *et al.* The impact of anti-tobacco industry prevention messages in tobacco producing regions: evidence from the US truth campaign. *Tob Control.* 2004;13(3):283–288.
- Cowell AJ, Farrelly MC, Chou R, Vallone DM. Assessing the impact of the national “truth” antismoking campaign on beliefs, attitudes, and intent to smoke by race/ethnicity. *Ethn Health.* 2009;14(1):75–91.
- Farrelly MC, Heaton CG, Davis KC, *et al.* Getting to the truth: evaluating national tobacco countermarketing campaigns. *Am J Public Health.* 2002;92(6):901–907.
- Hersey JC, Niederdeppe J, Ng SW, *et al.* How state counter-industry campaigns help prime perceptions of tobacco industry practices to promote reductions in youth smoking. *Tob Control.* 2005;14(6):377–383.
- Dietz NA, Sly DF, Lee DJ, Arheart KL, McClure LA, Correlates of smoking among young adults: the role of lifestyle, attitudes/beliefs, demographics, and exposure to anti-tobacco media messaging. *Drug Alcohol Depend.* 2013;130(1–3):115–21.
- Nguyen N, Lisha NE, Neilands TB, Jordan JW, Ling PM. Differential associations between anti-tobacco industry attitudes and intention to quit smoking across young adult peer crowds. *Am J Health Promot.* 2019;33(6):876–885.
- Farrelly MC, Duke JC, Nonnemaker J, *et al.* Association between the real cost media campaign and smoking initiation among youths - United States, 2014–2016. *MMWR Morb Mortal Wkly Rep.* 2017;66(2):47–50.
- Terry-McElrath YM, Wakefield MA, Emery S, *et al.* State anti-tobacco advertising and smoking outcomes by gender and race/ethnicity. *Ethn Health.* 2007;12(4):339–362.
- Vallone D, Cantrell J, Bennett M, *et al.* Evidence of the impact of the truth finishit campaign. *Nicotine Tob Res.* 2018;20(5):543–551.
- Kowitz SD, Lazard AJ, Queen TL, Noar SM, Goldstein AO. , Adolescents’ aided recall of targeted and non-targeted tobacco communication campaigns in the United States. *Int J Environ Res Public Health.* 2018;15(11):2363–2378.
- Wakefield M, Durrant R, Terry-McElrath Y, *et al.* Appraisal of anti-smoking advertising by youth at risk for regular smoking: a comparative study in the United States, Australia, and Britain. *Tob Control.* 2003;12 Suppl 2:ii82–ii86.
- White V, Tan N, Wakefield M, Hill D. do adult focused anti-smoking campaigns have an impact on adolescents? the case of the Australian National Tobacco Campaign. *Tob Control.* 2003;12 Suppl 2:ii23–ii29.
- Zhao X, Cai X. Exposure to the tips from former smokers campaign among adolescents in the United States. *Nicotine Tob Res.* 2016;18(5):971–975.
- Durkin S, Bayly M, Brennan E, Biener L, Wakefield M. Fear, sadness and hope: which emotions maximize impact of anti-tobacco mass media advertisements among lower and higher SES groups? *J Health Commun.* 2018;23(5):445–461.
- Terry-McElrath Y, Wakefield M, Ruel E, *et al.* The effect of antismoking advertisement executional characteristics on youth comprehension, appraisal, recall, and engagement. *J Health Commun.* 2005;10(2):127–143.
- Zhao X, Cai X. The association between exposure to “Tips” and smoking-related outcomes among adolescents in the United States. *Health Educ Res.* 2016;31(5):614–623.
- Centers for Disease Control and Prevention. Tips from Former Smokers; 2022. Centers for Disease Control and Prevention. <https://www.cdc.gov/tobacco/campaign/tips/index.html>. Updated March 17, 2022. Accessed March 7 2022.
- Colston DC, Cho B, Thrasher JF, *et al.* Anti-Smoking media campaigns and disparities in smoking cessation in the United States, 2001–2015. *Am J Health Promot.* 2021;35(5):658–668.
- McAfee T, Davis KC, Alexander RL, *et al.* Effect of the first federally funded US antismoking national media campaign. *Lancet.* 2013;382(9909):2003–2011.
- Duke JC, Davis KC, Alexander RL, *et al.* Impact of a U.S. antismoking national media campaign on beliefs, cognitions and quit intentions. *Health Educ Res.* 2015;30(3):466–483.
- Huang LL, Thrasher JF, Abad EN, *et al.* The U.S. national tips from former smokers antismoking campaign: promoting awareness of smoking-related risks, cessation resources, and cessation behaviors. *Health Educ Behav.* 2015;42(4):480–486.
- England L, Tong VT, Rockhill K, *et al.* Evaluation of a federally funded mass media campaign and smoking cessation in pregnant women: a population-based study in three states. *BMJ Open.* 2017;7(12):e016826e016826.
- McAfee T, Davis KC, Shafer P, *et al.* Increasing the dose of television advertising in a national antismoking media campaign: results from a randomised field trial. *Tob Control.* 2017;26(1):19–28.
- Miech RA, Johnston LD, O’Malley PM, *et al.*, *Monitoring the Future National Survey Results on Drug Use, 1975–2020: Volume I, Secondary School Students.* Ann Arbor MI: Institute for Social Research, The University of Michigan; 2021.
- Szcypka G, Emery S, Wakefield M, Chaloupka F. *The Adaptation and Use of Nielsen Media Research Commercial Ratings Data to Measure Potential Exposure to Televised Smoking-Related Advertisements.* Research Paper Series 2003 [cited 2021 October 1]; Available from: [https://impactteen.uic.edu/generalarea\\_PDFs/Nielsenpaper\\_051403.pdf](https://impactteen.uic.edu/generalarea_PDFs/Nielsenpaper_051403.pdf). Accessed March 7, 2022.
- Emery S, Kim Y, Choi YK, *et al.* The effects of smoking-related television advertising on smoking and intentions to quit among adults in the United States: 1999–2007. *Am J Public Health.* 2012;102(4):751–757.
- Pollay R, Siddarth S, Siegel M, *et al.* The last straw? cigarette advertising and realized market shares among youths and adults, 1979–1993. *J Marketing.* 1996;60(2):1–16.
- Colston DC, Xie Y, Thrasher JF, *et al.* Examining truth and state-sponsored media campaigns as a means of decreasing youth smoking and related disparities in the U.S. *Nicotine Tob Res.* 2022;24(4):469–477.

34. Colston DC, Xie Y, Thrasher JF, *et al.* Exploring how exposure to truth and state-sponsored anti-tobacco media campaigns affect smoking disparities among young adults using a national longitudinal dataset, 2002–2017. *Int J Environ Res Public Health*. 2021;18(15):7803–7814.
35. King J. *The Decision to go to College: Attitudes and Experiences Associated With College Attendance Among Low-Income Students*. Washington, DC: College Board, 16; 1996.
36. Cabrera A. and La Nasa S. *Understanding the College-Choice Process. New Directions for Institutional Research*. 2000. 107:5–22.
37. Gross Domestic Product: Implicit Price Deflator (GDPDEF). U.S. Bureau of Economic Analysis Federal Reserve Bank of St. Louis. Available from:<https://fred.stlouisfed.org/series/GDPDEF>. Accessed March 7, 2022.
38. U.S. Census Bureau; American Community Survey. *2005–2017 American Community Survey 1-Year Estimates*. American FactFinder; 2019.
39. The Tax Burden on Tobacco Volume 51, 1970–2016. Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2018. <https://chronicdata.cdc.gov/Policy/The-Tax-Burdenon-Tobacco-Volume-51-1970-2016/7nwe-3aj9>. Accessed March 7, 2022.
40. Gruber Y. *Youth smoking in the US: prices and policies*. Cambridge, MA: National Bureau of Economic Research 2000.
41. Zou G. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol*. 2004;159(7):702–706.
42. Dow W, Norton E, Donahoe J. Stata tip 134: multiplicative and marginal interaction effects in nonlinear models. *Stata J*. 2019;19(4):1015–1020.
43. Benjamini Y, Hochberg Y. Controlling the false discovery rate - a practical and powerful approach to multiple testing. *J R Stat Soc Series B Stat Methodol*. 1995;57(1):289–300.
44. Cummings P. Methods for estimating adjusted risk ratios. *Stata J*. 2009;9(2):175–196.
45. Raghunathan T, Lepkowski J, Van Hoewyk J, Solenberger P. A multivariate technique for multiply imputing missing values using a sequence of regression models. *Survey Methodol*. 2001;27:85–95.
46. Slater M. Integrating application of media effects, persuasion, and behavior change theories to communication campaigns: a stages-of-change framework. *Health Commun*. 1999;11(4):335–354.
47. Farrelly MC, Davis KC, Duke J, Messeri P. Sustaining “truth”: changes in youth tobacco attitudes and smoking intentions after 3 years of a national antismoking campaign. *Health Educ Res*. 2009;24(1):42–48.
48. Prior M. The immensely inflated news audience: assessing bias in self-reported news exposure. *Public Opin Q*. 2009;73(1):130–143.
49. Rainie, L. Cable and satellite TV use has dropped dramatically in the U.S. since 2015. 2021 [cited 2022 February 8]; Available from: <https://www.pewresearch.org/fact-tank/2021/03/17/cable-and-satellite-tv-use-has-dropped-dramatically-in-the-u-s-since-2015/>.