E-cigarettes and National Adolescent Cigarette Use: 2004–2014

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abstract

BACKGROUND: E-cigarette use is rapidly increasing among adolescents in the United States, with some suggesting that e-cigarettes are the cause of declining youth cigarette smoking. We hypothesized that the decline in youth smoking changed after e-cigarettes arrived on the US market in 2007.

METHODS: Data were collected by using cross-sectional, nationally representative school-based samples of sixth- through 12th-graders from 2004–2014 National Youth Tobacco Surveys (samples ranged from 16 614 in 2013 to 25 324 in 2004). Analyses were conducted by using interrupted time series of ever ($\geq$1 puff) and current (last 30 days) cigarette smoking. Logistic regression was used to identify psychosocial risk factors associated with cigarette smoking in the 2004–2009 samples; this model was then applied to estimate the probability of cigarette smoking among cigarette smokers and e-cigarette users in the 2011–2014 samples.

RESULTS: Youth cigarette smoking decreased linearly between 2004 and 2014 (P = .009 for ever smoking and P = .05 for current smoking), with no significant change in this trend after 2009 (P = .57 and .23). Based on the psychosocial model of smoking, including demographic characteristics, willingness to wear clothing with a tobacco logo, living with a smoker, likelihood of smoking in the next year, likelihood of smoking cigarettes from a friend, and use of tobacco products other than cigarettes or e-cigarettes, the model categorized <25% of current e-cigarette–only users (between 11.0% in 2012 and 23.1% in 2013) as current smokers.

CONCLUSIONS: The introduction of e-cigarettes was not associated with a change in the linear decline in cigarette smoking among youth. E-cigarette–only users would be unlikely to have initiated tobacco product use with cigarettes.

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WHAT'S KNOWN ON THIS SUBJECT: E-cigarette use is rapidly increasing among adolescents in the United States, with some suggesting increased e-cigarette use contributes to the decline in cigarette smoking.

WHAT THIS STUDY ADDS: The introduction of e-cigarettes was not associated with a change in the linear decline in cigarette smoking among youth but is expanding overall use. E-cigarette–only users would be unlikely to have initiated tobacco product use with cigarettes.

ARTICLE

Between 2011 and 2014, US adolescent e-cigarette use rapidly increased, with 13.4% of high school students and 3.9% of middle school students reporting past-30-day use in 2014. In 2014, between 13% and 40% of middle and high school e-cigarette users in Connecticut,[1] the United States,[2] and Canada[3] reported using e-cigarettes containing nicotine. (These reports may underestimate nicotine exposure because 8%–12% of students responded "don't know" to questions about e-cigarette contents,[1,2,4] and e-cigarettes labeled "nicotine-free" often contain nicotine.[5,6]) Nicotine exposure during adolescence can affect memory, attention, and emotional regulation.[7] E-cigarette aerosol has been linked to cell damage,[8] lung inflammation, asthma,[9] and respiratory infections.[8,10] Among Korean 10th- to 12th-grade never cigarette smokers, current (30-day) e-cigarette users were more likely to have been diagnosed with asthma and had 15.4 (95% confidence interval [CI]: 5.1–45.7) times the odds of missing ≥4 days of school in the past year due to asthma than did never e-cigarette users.[11] Adolescents who use e-cigarettes, but not cigarettes, show fewer of the psychosocial risk factors associated with smoking than do cigarette-smoking adolescents (but more than never e-cigarette users), such as rebelliousness, sensation seeking, and prevalence of peer smoking.[12,13] Longitudinal research consistently shows that never-smoking adolescent e-cigarette users are more likely than never e-cigarette users to subsequently start smoking cigarettes.[14–18]

At the same time that e-cigarette use was increasing, cigarette smoking among youth declined,[2,19] leading some to suggest that e-cigarettes are replacing conventional cigarettes among youth.[20–22] Researchers[23] and popular media[24–26] have suggested that e-cigarettes are contributing to

recent declines in youth smoking, and some have suggested that restricting e-cigarettes may harm public health.[27,28] Two analyses of the effects of enacting laws that prohibit the sales of e-cigarettes to youth aged <18 years reported that these laws were associated with increases of 0.9%[27] and 0.8%[28] in the absolute prevalence of cigarette smoking among adolescents. Neither of these reports measured e-cigarette use. In contrast, results from Southern California indicated that e-cigarette use is occurring in adolescents who would not otherwise have used tobacco products.[29] We used the 2004–2014 National Youth Tobacco Survey (NYTS) to assess whether the decline in adolescent cigarette smoking changed after e-cigarettes entered the US market (around 2007[30–33]) and the extent to which e-cigarettes are attracting youth who would be unlikely to begin nicotine use with cigarettes on the basis of known psychosocial predictors of the onset of cigarette use.

METHODS

Sample

We used data from the 2004, 2006, 2009, 2011, 2012, 2013, and 2014 school-based paper-and-pencil NYTS, a repeated, cross-sectional, nationally representative, 3-stage cluster (counties, schools, grades) sample of sixth- to 12th-graders (ages 9–21).[34] School response rates ranged from 75% in 2013 to 93% in 2004, and student response rates varied from 88% in 2004, 2006, and 2011 to 93% in 2009.[34] Participants with missing values for demographic characteristics, psychosocial predictor variables, ever or current smoking, e-cigarette use (available in 2011–2014 surveys), or use of tobacco products other than cigarettes or e-cigarettes were excluded from this analysis (6.6% in 2004 to 10.1% in 2009 and 2011 who were missing data), yielding analytic

samples of 15 664 in 2013 to 24 690 in 2004.

Measures

Cigarette Smoking

"Ever smokers" were those who responded "yes" to "Have you ever tried cigarette smoking, even 1 or 2 puffs?" "Current smokers" reported the use of cigarettes during the past 30 days on at least 1 day. We also examined number of days smoked in the past 30 days among current smokers (1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days, or all 30 days).

E-cigarette Use

E-cigarettes were first included in the NYTS in 2011. From 2011 through 2014, participants were "ever e-cigarette users" if they replied "electronic cigarettes or e-cigarettes" to "Which of the following tobacco products have you ever tried, even just one time?" Participants were defined as "current e-cigarette users" if they reported the use of e-cigarettes during the past 30 days on at least 1 day.

Never smokers with a missing response for 30-day smoking were considered noncurrent smokers. Never e-cigarette users with a missing response for 30-day e-cigarette use were considered noncurrent e-cigarette users.

Other Tobacco Use

We included ever and current use of all tobacco products besides cigarettes and e-cigarettes that were assessed in every NYTS conducted between 2004 and 2014: chewing tobacco, snuff, or dip; cigars, cigarillos, or little cigars; tobacco in a pipe; or bidis. Respondents who reported ever using any of these products (ie, other than cigarettes or e-cigarettes) were considered "ever other" tobacco users, and those who reported using them in the past 30 days were considered "current other" tobacco users. The prevalence

of other tobacco use did not change significantly between 2004 and 2014, averaging 5.1% for ever use and 4.4% for current use (*P* for trend with time: .26 and .81, respectively).

Psychosocial Risk Factors

We examined psychosocial risk factors for cigarette smoking or e-cigarette use identified in previous research that were also available for the 2004–2014 NYTS data. Continuous psychosocial variables included the following:

"Do you think the smoke from other people's cigarettes is harmful to you?"

"If one of your best friends offered you a cigarette, would you smoke it?"

"Do you think you will smoke a cigarette at any time during the next year?"

"Do you think smoking cigarettes makes young people look cool or fit in?" and

"Would you ever use or wear something that has a tobacco company name or picture on it such as a lighter, t-shirt, hat, or sunglasses?"

Response options were "definitely yes," "probably yes," "probably not," and "definitely not." We also examined the questions "How many of your closest friends smoke cigarettes?" as a continuous predictor variable (response options were none and 1, 2, 3, or 4; unavailable for 2012) and "Does anyone who lives with you now smoke cigarettes?" (yes or no) as a dichotomous predictor. All variables were coded so that higher values reflected higher risk of cigarette smoking.

Covariates

Male sex (reference: female); non-Hispanic black, Hispanic, or non-Hispanic other race (reference: non-Hispanic white); and continuous age were included in all adjusted models as covariates.

Analysis

Centers for Disease Control and Prevention–provided stratification variables were included to adjust for clustered sampling techniques. Centers for Disease Control and Prevention–provided weights were included to adjust for nonresponse and to match sample characteristics to national estimates.[35] We used SAS surveyfreq (SAS Institute, Cary, NC) to compute the prevalence of ever and current cigarette smoking, e-cigarette use, and other tobacco use and days smoked per month for each year.

Time Series Analysis

We conducted an interrupted time series analysis of the impact of the appearance of e-cigarettes on the US market on youth cigarette smoking prevalence over time. We accounted for the uncertainty in prevalence at each time point by using Stata 12.0 meta-regression, which incorporates 95% CIs for prevalence in addition to point estimates (StataCorp, College Station, TX). We tested for a slope change in the rate of decline in cigarette smoking by including a variable that was zero before 2009 and equal to (year–2009) beginning in 2009 (ie, 0 in 2009, 1 in 2010, etc). We used 2009 because it was the closest wave of NYTS data to 2007, when e-cigarettes entered the US market.[30–33] It was unnecessary to adjust for clustering variables and weights in the meta-regression because we used SAS surveyfreq–generated prevalence and SEs (adjusted by weights and clustering variables) in the meta-regression. We examined changes in demographic characteristics across NYTS waves to determine whether we needed to include demographic variables in the meta-regression. We found a slight increase in the prevalence of Hispanic participants over time. Because including Hispanic ethnicity in the meta-regression model induced collinearity (variance inflation

factor = 23.0), we did not adjust for demographic characteristics in the meta-regression.

Psychosocial Model To Predict Cigarette Smoking

We developed a psychosocial model of cigarette smoking to estimate the probability that e-cigarette users would have initiated nicotine use with cigarettes. We hypothesized that, if e-cigarettes are attracting youth who would have smoked cigarettes eventually, e-cigarette–only users would display many of the psychosocial risk factors associated with conventional cigarette use, including the following: rebelliousness,[12] sensation seeking,[12] peer smoking prevalence,[12,13,36] living with someone who smokes,[13] positive attitudes toward cigarettes,[13] parental smoking,[36] likelihood of smoking in the next year,[37] likelihood of accepting a cigarette from a friend,[37] and use of other tobacco products.[38] Alternatively, if e-cigarettes are attracting low-risk youth,[12,13] e-cigarette–only users would have a low probability of smoking cigarettes.

We used SAS proc surveylogistic to develop the predictive model of cigarette smoking using the pooled 2004–2009 data. We used percentage concordance between model-estimated and self-reported smoking to determine the best-fitting model (ie, which psychosocial variables to include). We included all psychosocial variables significant in bivariate analyses of either ever or current smoking, as well as time (year, centered on 2009). We also tested for interactions between time and all other predictor variables to test for changes in predictor variables across waves.

After developing the final models on the basis of the 2004–2009 data, we applied the resulting logistic regression equations to the 2011–2014 data to predict respondents' odds of ever or
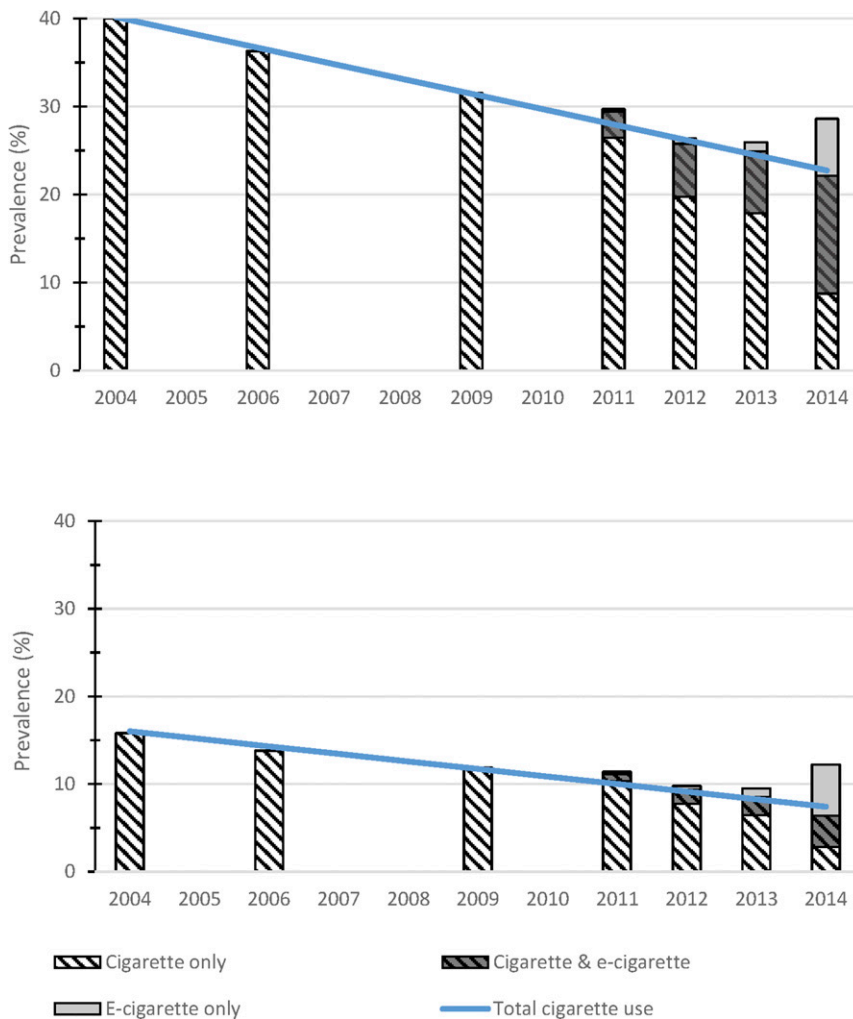
FIGURE 1
The advent of e-cigarettes did not affect declining trends in ever (≥1 puff lifetime; top panel) or current (use in past 30 days; bottom panel) cigarette use in the NYTS, including dual use with e-cigarettes (dark-gray, cross-hatched shading). E-cigarette–only users (light-gray shading) are in addition to youth who are smoking cigarettes and are at low risk of having initiated tobacco products with cigarettes. (E-cigarette use, defined by using the same criteria as cigarettes, was assessed starting in 2011.)

current smoking (odds ratio [OR] >1.0 classified as smokers, OR <1.0 classified as nonsmokers). We used SAS surveyfreq to compare model-estimated smoking prevalence with self-reported cigarette and e-cigarette–only use for 2011–2014.

We tested the model by splitting the pooled 2004–2009 data in half, at random, 4 times and then used the first half of the data to estimate the model and the second half to test the model's predictive ability. The coefficients in the model used to predict smoking behavior in the 2011–2014 data were computed for the entire 2004–2009 sample.

RESULTS

Changes in Cigarette and E-cigarette Use Over Time

Ever smoking decreased from 40.0% in 2004 to 22.1% in 2014 (Fig 1). Total ever use of cigarettes or e-cigarettes accounting for dual use decreased slightly from 29.8% in 2011 (26.5% cigarettes only, 3.0% dual use, and 0.3% e-cigarettes only) to 28.6% in 2014 (8.7% cigarettes only, 13.4% dual use, and 6.5% e-cigarettes only).

Current smoking decreased from 15.8% in 2004 to 6.4% in 2014. Total combined current use of cigarettes and e-cigarettes accounting for dual use (Fig 1) increased from 11.4% in 2011 (10.3% current cigarettes only, 0.8% current dual use, and 0.3% current e-cigarettes only) to 12.2% for 2014 (2.8% current cigarettes only, 3.6% current dual use, and 5.8% current e-cigarettes only). Among current smokers, infrequent smoking (1–2 days/month) increased from 25.9% in 2004 to 37.6% in 2014. Daily smoking decreased from 28.8% in 2004 to 21.5% in 2014.

Change in Decline in Cigarette Use After the Introduction of E-cigarettes

Ever cigarette smoking, including dual use after 2011, showed a continuous linear decline over the study period (2004–2014; $P = .009$), with no significant slope change after the introduction of e-cigarettes in 2009 ($P = .57$; Fig 1). Likewise, there was a decline in current smoking ($P = .05$) that did not change after the introduction of e-cigarettes ($P = .23$; Fig 1).

Psychosocial Predictive Model

On the basis of the full 2004–2009 data set, the following characteristics were significantly associated with higher odds of cigarette smoking (Table 1): Hispanic, non-Hispanic black, or non-Hispanic other race/ethnicity; older age; willingness to wear clothing with a tobacco company logo; living with a smoker; higher likelihood of smoking in the next year; higher likelihood of accepting a cigarette from a friend; and other tobacco product use. Male sex and the passage of time was associated with lower odds of smoking (smoking prevalence declined over time). With the use of the entire 2004–2009 sample, the model correctly classified 70.6%

of ever smokers as ever smokers and 75.3% of past-30-day smokers as current smokers. (These values are similar to the results from the 4 randomly generated validation samples, which correctly classified between 70.0% and 70.7% of ever smokers as ever smokers and between 74.0% and 76.7% of past-30-day smokers as current smokers.)

There were no significant interactions between time and the predictor variables in the model of ever smoking. There were significant interactions for time and male sex (P = .007) and the likelihood of smoking in the next year (P = .03) for current smoking. The influence of male sex on current smoking increased over time (OR: 1.08; 95% CI: 1.02–1.14); for each 1-year increase in time, the odds of current smoking were 8% higher for males than for females. The influence of the likelihood of smoking in the next year on 30-day smoking status declined over time (OR: 0.97; 95% CI: 0.94–0.997); for each 1-year increase in time, the odds of being a current smoker in the next year decreased by a factor of 0.97. Because including the interaction terms did not improve percentage concordance in the predictive model, and effect estimates changed little, we did not include the interaction term in the final model for ever smoking. When both interaction terms were included, the ORs (95% CIs) of ever smoking were 0.95 (0.77–1.17) for male sex, 2.97 (2.62–3.36) for the likelihood of smoking in the next year, and 0.95 for time (0.90–1.01) compared with 0.76 (0.69–0.83) for male sex, 2.29 (2.10–2.49) for the likelihood of smoking in the next year, and 0.93 (0.91–0.96) for time when the interaction terms were not included.

Model-Estimated Cigarette Smoking Among Self-Reported Cigarette and E-cigarette–Only Use, 2011–2014

The psychosocial model predicted between 3.2% and 6.9% of never users of cigarettes and e-cigarettes

TABLE 1 Psychosocial Predictive Logistic Regression Model of Smoking Created by Using 2004–2009 NYTS Data

Variable	Outcome	
	Ever Smoking[a]	Current Smoking[b]
Male	0.74 (0.69–0.79)	0.77 (0.69–0.87)
Race/ethnicity		
Non-Hispanic white	Ref	Ref
Hispanic	1.57 (1.45–1.69)	0.97 (0.84–1.11)
Non-Hispanic black	1.79 (1.64–1.95)	1.01 (0.85–1.21)
Non-Hispanic other	1.20 (1.08–1.34)	1.08 (0.88–1.32)
Age	1.36 (1.34–1.38)	1.33 (1.30–1.37)
Would wear logo	1.11 (1.07–1.16)	0.86 (0.81–0.92)
Live with a smoker	2.43 (2.29–2.59)	2.05 (1.85–2.28)
Intend to smoke in next year	1.85 (1.75–1.96)	3.24 (3.01–3.49)
Likely to smoke a cigarette from a friend	2.37 (2.23–2.52)	3.27 (3.03–3.54)
Other tobacco use[c]	7.22 (6.67–7.82)	4.78 (4.19–5.45)
Year (centered on 2009)	0.91 (0.90–0.93)	0.93 (0.91–0.96)
Concordance, %	89.4	95.8

Data are presented as ORs (95% CIs) unless otherwise indicated. All models include NYTS-provided weights and stratification variables.
[a] Ever smoking was defined as ≥1 puff of a cigarette.
[b] Current smoking was defined as smoking cigarettes in the past 30 days.
[c] This category includes the use of tobacco products other than cigarettes that are consistent across all years of the NYTS between 2004 and 2014: chewing tobacco, snuff, or dip; cigars, cigarillos, or little cigars; tobacco in a pipe; or bidis.

as ever cigarette smokers, between 40.7% and 52.2% of e-cigarette–only users as ever smokers, and between 68.6% and 70.3% of participants who reported ever having smoked cigarettes (including dual users with e-cigarettes) as ever smokers between 2011 and 2014 (Table 2). The model classified between 1.8% (2014) and 5.9% (2013) of respondents who reported neither smoking nor using e-cigarettes in the past 30 days as current smokers, between 11.0% (2012) and 23.1% (2013) of past-30-day e-cigarette–only users as current cigarette smokers, and between 75.1% (2013) and 76.9% (2012) of past-30-day cigarette smokers as current cigarette smokers.

DISCUSSION

Youth ever and current cigarette smoking decreased from 2004 to 2014. The downward trend in cigarette smoking (including dual users) was not affected by the introduction of e-cigarettes. Because of increases in e-cigarette–only use, combined 30-day use of cigarettes

and e-cigarettes (accounting for dual use) was higher in 2014 than in 2011.

Although most (75%–77%) of the youth who reported smoking cigarettes in the past 30 days (including dual users of cigarettes and e-cigarettes) in 2011–2014 had risk profiles (based on 2004–2009 data) consistent with smoking cigarettes, only 11%–23% of e-cigarette–only users were predicted to be current cigarette smokers. Participants who did not use cigarettes or e-cigarettes were least likely to be predicted to be cigarette smokers. These findings are consistent with the existing literature showing that e-cigarette–only users display a lower risk profile than cigarette smokers for smoking cigarettes.[12,13,36,37]

The use of e-cigarettes among nonsmoking youth is of concern because 4 longitudinal studies suggest that youth and young adults who initiate use with e-cigarettes have 3 times the odds of becoming cigarette smokers 1 year later.[14–18] Never-smoking low-risk youth who use e-cigarettes may be more likely to go on to initiate cigarette smoking compared with never-smoking

TABLE 2 Percentage of Youth Predicted To Smoke by Using the Psychosocial Model (2004–2009 NYTS)

	Predicted Cigarette Smoking Status[a]			
Actual Participant Smoking Status	2011	2012	2013	2014
Ever smoker[b]				
Never smoker/never user[c]	5.4 (4.6–6.3)	6.1 (5.5–6.9)	6.9 (6.1–7.9)	3.2 (2.7–3.8)
Actual ever e-cigarette–only user[d]	52.2 (22.3–80.7)	40.7 (31.0–51.2)	48.3 (36.2–60.5)	50.9 (47.3–54.6)
Actual ever smoker[e]	70.3 (68.0–72.6)	70.0 (67.8–72.1)	68.6 (66.5–70.6)	69.9 (67.8–72.0)
Current smoker[f]				
Noncurrent smoker/noncurrent user[g]	5.5 (4.9–6.2)	4.9 (4.4–5.5)	5.9 (5.2–6.7)	1.8 (1.5–2.2)
Actual current e-cigarette–only user[h]	19.6 (4.0–58.5)	11.0 (5.4–21.1)	23.1 (14.7–34.4)	15.4 (13.5–17.5)
Actual current smoker[i]	76.5 (73.2–79.5)	76.9 (74.7–79.0)	75.1 (71.9–78.1)	76.7 (72.5–80.5)

Data are presented as percentages (95% CIs). All analyses adjusted for NYTS-provided weights and stratification variables.

[a] Estimated likelihood of smoking cigarettes based on a psychosocial model of smoking created by using 2004–2009 NYTS data on sex, race/ethnicity, age, willingness to wear clothing that bears a tobacco logo, living with a smoker, intention to smoke cigarettes in the next year, likelihood of smoking a cigarette offered by a friend, other tobacco product use (besides cigarettes and e-cigarettes), and time (centered on 2009).

[b] Model-estimated likelihood of ever taking a puff of a cigarette.

[c] Reported never taking a puff of a cigarette or e-cigarette.

[d] Endorsed having ever taken ≥1 puff of an e-cigarette but not smoking ≥1 puff of a cigarette.

[e] Reported taking ≥1 puff of a cigarette in lifetime, including dual users of cigarettes and e-cigarettes.

[f] Model-estimated likelihood of having smoked cigarettes in the past 30 days.

[g] Did not report smoking cigarettes or using an e-cigarette in the past 30 days.

[h] Reported using an e-cigarette in the past 30 days but not smoking cigarettes in the past 30 days.

[i] Reported smoking cigarettes in the past 30 days.

low-risk youth who are not using e-cigarettes.[39] Two cross-sectional studies in youth[40,41] indicate that, like adults,[42] youth smokers who are using e-cigarettes want to quit but are less likely to be former smokers. Many e-cigarette users also smoke cigarettes,[43] but this fact does not change the finding that e-cigarettes appear to be attracting some low-risk youth.

Consistent with our results, CNA Analytics and Solutions[44] used 2002–2006 NYTS data to create a primarily demographic characteristic–based predictive model (year, sex, race/ethnicity, grade level, age, and living with a smoker) of cigarette smoking and chewing tobacco use and applied it to youth in the 2011–2014 NYTS. They found a higher prevalence of e-cigarette use among 2011–2014 NYTS participants who their model categorized as at high risk of cigarette smoking and/or using chewing tobacco as well as e-cigarette users that met their criteria for being at low risk of smoking and/or using chewing tobacco.

State and local governments have responded to research on e-cigarettes by including e-cigarettes in smoke-free and retailer licensing laws,[45,46]

which may affect use. In May 2016, the Food and Drug Administration issued a "deeming" rule asserting jurisdiction over e-cigarettes,[47] but took no steps to regulate aggressive television advertising,[48] product placement in movies,[49] youth-friendly flavors,[50–52] nicotine content,[53,54] or health claims (including cessation).[50] Banning advertising is particularly important because recent research reveals that youth exposed to e-cigarette advertising perceived less harm from occasional or light smoking than do youth who are not exposed.[55]

Limitations

This analysis uses cross-sectional data, so we cannot conclude that the presence of e-cigarettes in the marketplace caused a change (or lack thereof) in the prevalence of cigarette smoking. However, we did not find any evidence of such a change. Because of the cross-sectional nature of the data, we also could not determine whether dual users of cigarettes and e-cigarettes initiated use with cigarettes or e-cigarettes. The NYTS does not include school dropouts, who may have higher tobacco use than adolescents who stay in school. The

NYTS questionnaire items assessing the use of other tobacco products varied over time (Supplemental Table 3), so we only included those products assessed at all waves. The NYTS did not assess the frequency of e-cigarette use before 2014. The 2011–2014 NYTS also did not ask participants whether the e-cigarettes they were using contained nicotine, meaning that our total estimate of combined cigarette and e-cigarette use likely contains some youth who used nicotine-free e-cigarettes.

Conclusions

Consistent with regional data from Southern California,[29] the lack of a demonstrable acceleration in the long-term rate of decline in youth smoking prevalence after the introduction of e-cigarettes does not support the hypothesis that this decline is due to youth substituting e-cigarettes for conventional cigarettes. In contrast, the rapid increase in e-cigarette use by youth resulted in higher levels of 30-day use of cigarettes and e-cigarettes in 2014 than in 2011. The observation that youth who initiate use with e-cigarettes are more likely to start smoking conventional cigarettes[14–18] and, among smokers, are less likely

to have stopped smoking[17,40,41] also raises the possibility that the long-term decline in cigarette smoking we observed will reverse in future years.

Indeed, the 2015 NYTS data[56] raise concerns that this process may be starting. The small decline in middle school smoking between 2014 and 2015 (2.5% to 2.3%) and the small increase in high school smoking (9.2% to 9.3%) are consistent with longitudinal research suggesting that youth who initiated use with e-cigarettes only (ie, in 2014) are more likely to be smoking cigarettes a year later[14–18] (ie, in 2015).

Clinicians should assess the use of all tobacco products (including cigarettes, e-cigarettes, and other tobacco products) to accurately capture adolescent tobacco use, keeping in mind that this behavior is evolving. E-cigarettes should be included in smoke-free laws, state tobacco control programs, taxed to lower youth initiation, and sales of products with youth-friendly flavors prohibited. State and national media campaigns (particularly the Truth Initiative's "truth," the Food and Drug Administration's *The Real Cost*, and the Centers for Disease Control and Prevention's *Tips From Former Smokers* campaigns) should educate youth that e-cigarettes are not harmless and attract youth at low risk of initiating tobacco use with conventional cigarettes, and that their use predicts higher chances of going on to smoke conventional cigarettes.

ABBREVIATIONS

CI: confidence interval
NYTS: National Youth Tobacco Survey
OR: odds ratio

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