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Original article

## Reasons for Vaping among U.S. 12th Graders

 Rebecca J. Evans-Polce, Ph.D.<sup>a,\*</sup>, Megan E. Patrick, Ph.D.<sup>a</sup>, Stephanie T. Lanza, Ph.D.<sup>b</sup>,  
 Richard A. Miech, Ph.D.<sup>a</sup>, Patrick M. O'Malley, Ph.D.<sup>a</sup>, and Lloyd D. Johnston, Ph.D.<sup>a</sup>
<sup>a</sup> Institute for Social Research, University of Michigan, Ann Arbor, Michigan<sup>b</sup> The Methodology Center and Department of Biobehavioral Health, Pennsylvania State University, University Park, Pennsylvania

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 A B S T R A C T

**Introduction:** Vaping has recently increased in popularity among adolescents. Little is known about heterogeneity of vapers, particularly in terms of why they vape. Identifying major subgroups of adolescent vapers by reasons for vaping is important to understand adolescent vaping behavior and to identify those most at risk for other substance use.

**Methods:** Monitoring Future data from 2015 and 2016 were used in a latent class analysis to identify subgroups of 12th graders based on their endorsement of 10 potential reasons for vaping. Multinomial regression with a latent class outcome was used to predict class membership.

**Results:** Three distinct classes of vapers were identified: adolescents who were (1) Vaping to Experiment (29.4%), (2) Vaping to Replace Cigarettes (7.3%), and (3) Vaping for Taste + Entertainment (63.4%). Vaping only flavors was associated with lower odds of membership and cigarette use was associated with higher odds of membership in the Vaping to Replace Cigarettes subgroup, and marijuana was associated with lower odds of membership in the Vaping to Experiment subgroup, compared with the Vaping for Taste + Entertainment subgroup.

**Conclusions:** This study identified multiple subgroups of vapers based on reasons for vaping. Whereas a small subgroup vaped for reasons related to cigarette use, most adolescent vapers reported vaping for reasons unrelated to cigarette use. There were considerable differences in primary reasons for vaping and risk for traditional cigarette and other substance use, suggesting different intervention strategies may be needed for different subgroups of vapers.

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 IMPLICATIONS AND  
 CONTRIBUTIONS

This study identifies patterns of why adolescents vape and how these reasons relate to cigarette smoking and other substance use. A minority of adolescents vape for cigarette-related reasons, consuming nicotine through multiple mechanisms. Adolescents who vape to experiment have lower risks, but may be at risk for escalation of vaping or other substance use.

The prevalence of vaping among adolescents has skyrocketed over the past five years, increasing from 1.5% in 2011 to 16.0% in 2015 among U.S. high school students [1], and has recently surpassed rates of cigarette use [2,3]. Vaping is the inhalation of an aerosol or vapor, which may or may not contain nicotine, produced by a device such as an electronic cigarette. Spending on

vaping advertising has greatly increased (from \$6.4 million in 2011 to \$115 million in 2014) and targets youth specifically [4]. More than 18 million U.S. middle and high school students were exposed to vaping advertisements in 2014. A recent review of e-cigarette research suggests that awareness of vaping is rapidly increasing among teens [5], potentially leading to even greater increases in vaping in the future.

Understanding why adolescents are vaping becomes an important research endeavor given the fast rise to popularity and the potentially harmful consequences of vaping for youth, such as escalation to cigarette smoking [6]. Experimentation [7], curiosity [8,9], flavoring or taste [7,10], and enjoyment [11] top the list of reasons for vaping among adolescents. Less than 10% of

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\* Address correspondence to: Rebecca J. Evans-Polce, Ph.D., Institute for Social Research, University of Michigan, 426 Thompson St., Ann Arbor, MI 48106.

E-mail address: bjevans@umich.edu (R.J. Evans-Polce).

middle and high school students report vaping to help facilitate smoking cessation [7], and a slightly higher percentage in a sample of college students (14%–19%) endorsed vaping to replace or stop cigarette smoking [11]. Somewhat larger percentages of youth and young adults (up to 80% of vapers) report vaping because they believe it is safer and more convenient than smoking cigarettes [8,10].

To date, studies have examined individual reasons for vaping among adolescents, with each reason explored separately. This approach provides the reasons teens give for vaping; however, it does not tell us how these reasons cluster together among vapers. We do not know the extent to which subgroups of adolescent vapers are motivated by a single reason for use or, alternatively, by a set of inter-related reasons. Given that distinct subgroups of users have been found for other substances (including alcohol [12], marijuana [13], and nonmedical prescription drug use [14]) based on their reasons for use, we expect to find that reasons for use may also distinguish vapers into meaningful subgroups. Documenting heterogeneity in patterns of reasons for adolescent vaping may be particularly informative for adolescent vapers given the current debate over whether adolescent vapers do so to aid in smoking cessation, as a supplement to smoking, or for reasons unrelated to cigarette smoking [1,8,9,15]. It is likely that more than one of these groups exist among adolescent vapers.

Understanding what individual characteristics, such as sociodemographics and other substance use, are associated with subgroups of vapers will further shed light on the heterogeneity of vapers and why they vape. It may also help to identify which vapers are at risk for heavier vaping and other substance use, including current and future use of traditional cigarettes. Overall, vaping is associated with and prospectively predictive of other risk behaviors such as traditional cigarette use and other substance use [6,16–20]. Most high school vapers report relatively infrequent vaping [19] and a majority (65% of 12th graders) report vaping only flavors without nicotine, marijuana, or other substances [21]. These potentially lower risk behaviors may be associated with a specific pattern of reasons for vaping whereas those vaping nicotine or other substances (e.g., marijuana) may vape for a different pattern of reasons. Understanding how these characteristics relate to different patterns of reasons for use would inform our understanding of what sets of reasons for vaping may be riskier than others. This would also inform intervention strategies as different types of interventions may be effective for different types of adolescents who vape. Interventions addressing higher-risk reasons for vaping as well as their other risk behaviors may be best suited to a higher-risk subgroup of vapers, whereas this type of intervention would be ill-suited for those who vape primarily for experimentation and may not be using other substances. The present study, using national samples of 12th graders who have vaped, has two aims:

- (1) To identify subgroups (or “classes”) of adolescents based on their self-reported reasons for vaping. Given that recent studies have found considerable heterogeneity among vapers [22,23], we hypothesize there will be heterogeneity in adolescents’ patterns of reasons for vaping, with the majority of adolescents vaping for experimental reasons only [7] rather than social, enhancement, or cigarette use-related reasons.
- (2) To identify characteristics associated with the classes identified in Aim 1. We hypothesize that adolescents who do

not report use of other substances will be more likely to vape for experimental reasons only; further, we hypothesize that those who report other substance use and report vaping substances (other than just flavoring) will be more likely to vape for social reasons and cigarette-related reasons.

## Methods

### Participants/sample

Data are from the Monitoring the Future (MTF) study, which since 1975 has conducted annual cross-sectional surveys of nationally representative samples of 12th grade students in public and private schools across the contiguous United States [24]. The survey was administered using optically scanned paper-and-pencil questionnaires administered in classrooms during normal school hours. The MTF study was approved by the University of Michigan Institutional Review Board.

This study focuses on 12th graders who completed the 2015 and 2016 surveys when questions regarding reasons for vaping were included in the survey. In the MTF study, students are randomly assigned to one of six different questionnaire forms to increase the number of topics covered and reduce respondent burden. Questions regarding reasons for vaping were included on two forms, thereby including one-third of students; among these students, only those who reported any lifetime vaping (34.7% of the original sample) were asked about their reasons for vaping (N = 2,664; 43% female and 63% white).

### Measures

**Reasons for vaping.** Students who reported ever vaping were asked about potential reasons for vaping with the question: “What have been the most important reasons for your using an electronic vaporizer such as an e-cigarette? (Mark all that apply).” [7] Ten potential reasons were given: “to experiment—to see what it’s like,” “because it tastes good,” “because of boredom, nothing else to do,” “to have a good time with my friends,” “to relax or relieve tension,” “because it looks cool,” “to help me quit regular cigarettes,” “because regular cigarette use is not permitted,” “to get high,” and “because I am ‘hooked’—I have to have it.” These 10 reasons were included as dichotomous (marked vs. not marked) indicators in the latent class analysis.

**Covariates.** We assessed whether vaping characteristics and other substance use were related to latent class membership. Vaping characteristics included recency of vaping (any past 30-day vaping vs. not) and whether the participant reported vaping only flavorings vs. vaping a substance (nicotine, marijuana, other substance) the last time they vaped. Other substance use included past 30-day cigarette use (any vs. none), past 30-day alcohol use (any vs. none), and past 30-day marijuana use (any vs. none). We also controlled for sociodemographic characteristics in multivariable regression models which included sex, race/ethnicity (white non-Hispanic, black non-Hispanic, Hispanic, Other), and parent education (parent(s) with a college degree versus no parent with a college degree).

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