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Electronic cigarette and marijuana use among youth in the United States

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HIGHLIGHTS

- Youth have a high rate of e-cigarette use and a decrease in perceived harm of marijuana use.
- The dual use of e-cigarettes and marijuana rapidly increased among 8th, 10th, and 12th graders.
- This study shows that youth might start to use e-cigarettes at an earlier age and then progress to other substances.

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ABSTRACT

Background: There are growing concerns over the high rate of electronic cigarette (e-cigarette) use and decreases in perceived harm of marijuana use among youth. We seek to identify risk factors associated with e-cigarette and marijuana use among U.S. middle and high school students.
Methods: Estimates of e-cigarette use only, marijuana use only, dual use of both substances as well as frequency of substance use were calculated for 8th, 10th and 12th grades with the typical age of 13, 15, 17 years old respectively by using the 2014 Monitoring the Future survey (n = 16,184).
Results: Overall, 7.9% of students only used e-cigarettes, 9.3% of students only used marijuana, and 6.6% of students used both e-cigarettes and marijuana in the last 30 days. E-cigarette use only was most prevalent among 8th and 10th graders while marijuana use only was most prevalent among 12th graders. The dual use of e-cigarettes and marijuana rapidly increased from 8th graders (2.6%) to 10th graders (7.3%) and maintained a high level for 12th graders (8.5%). Students' sociodemographic factors, school performance and work intensity were associated with e-cigarette and marijuana use in the multivariate analysis. Being a dual user of e-cigarettes and marijuana was associated with increased risk of a medium level or a high level of e-cigarette use and a medium level of marijuana use
Conclusions: This study raised the possibility that youth start to use e-cigarettes at an earlier age and then progress to other substances. Education campaigns with tailored messages to prevent youth from vaping and drug use are critically needed.

1. Introduction

The 2015 Monitoring the Future survey (MTF) shows encouraging news of declining use of alcohol, cigarettes and other licit and illicit substances among American 8th, 10th, and 12th graders, but there are growing concerns over the high rate of electronic cigarette (e-cigarette) use and decreases in perceived harm of marijuana use (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2016). The use of e-cigarettes has been rising exponentially among adolescents since it entered the US market in 2007. According to the 2015 National Youth Tobacco Survey, e-cigarette use among middle and high school students in the US quadruped in 2 years, rising from approximately 780,000 in 2013 to over 3 million students in 2015 (Singh et al., 2016). Teen use of e-cigarettes has outpaced the use of traditional cigarettes. In 2015, about 16% of 12th graders reported using an e-cigarette over the past month compared with 11% who reported they had smoked a cigarette (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2016). In the meantime, marijuana use among teens remained steady in 2015 and the past month use of marijuana was 21.3% for 12th graders, 14.8% for 10th graders, and 6.5% for 8th graders, respectively Johnston et al. (2016). However, the teens' attitudes toward risks of marijuana use have been declining and fewer students

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consider smoking marijuana as a harmful behavior. The percentage of high school seniors who perceived regular use of marijuana as harmfulness dropped from 52.4% in 2009 to 27.4% in 2015, while the percentage of high school seniors who perceived occasional use of marijuana as harmfulness dropped from 31.9% in 2009 to 15.8% in 2015 (Johnston et al., 2016).

Recent studies have examined the drug use patterns among adolescents, including e-cigarettes, cigarettes, marijuana and other substances (Lee, Hebert, Nonnemaker, & Kim, 2015; Miech, Johnston, O'Malley, Bachman, & Schulenberg, 2015a; Miech, O'Malley, Johnston, & Patrick, 2015a; Miech, O'Malley, Johnston, & Patrick, 2015b; Morean et al., 2016; Wills, Knight, Williams, Pagano, & Sargent, 2015). They found a substantial prevalence of dual use of e-cigarettes and cigarettes (Wills, Knight, Williams, Pagano, & Sargent, 2015) and poly use of multiple substances (Lee, Hebert, Nonnemaker, & Kim, 2015; Miech, O'Malley, et al., 2015b; Morean et al., 2016). Furthermore, the emergence of e-cigarette vaporizers has given cannabis users a new method to vape cannabis and it is gaining popularity as an alternative way to smoke cannabis (Lee, Crosier, Borodovsky, Sargent, & Budney, 2016; Morean, Kong, Camenga, Cavallo, & Krishnan-Sarin, 2015). Through an online survey of 2,910 adults who were cannabis users, Lee et al. (Lee et al., 2016) found a proliferation of vaping behaviors: 37% reported vaping in the past 30 days and 20% reported vaping >100 lifetime days. Morean et al. (Morean et al., 2015) surveyed 3,847 Connecticut high school students and found a high rate of vaporizing cannabis among lifetime e-cigarette users, lifetime cannabis users, and lifetime dual users. However, most current studies have primarily focused on dual use of e-cigarettes and tobacco or multiple substance use (Lee et al., 2015; Miech, O'Malley, et al., 2015b; Morean et al., 2016; Wills et al., 2015). A few studies (Lee et al., 2016; Morean et al., 2015) examined dual use of e-cigarettes and cannabis, but these studies were based on regional surveys on life-time users. To the best of our knowledge, there is no study to examine the current use of e-cigarettes and marijuana among youth from a nationally representative sample. Past studies (Bachman, Staff, O'Malley, & Freedman-Doan, 2013; Henry, 2010; Paulson, Coombs, & Richardson, 1990) also found a direct relationship between school performance, work intensity and drug use patterns, but little is known about how school performance and students' working hours are associated with e-cigarette use and dual use of e-cigarettes and marijuana. Furthermore, most of current studies analyzed the prevalence of e-cigarette and marijuana use but did not investigated the frequency of substance use (Lee et al., 2015; Miech, O'Malley, et al., 2015b; Morean et al., 2016; Wills et al., 2015). However, defining current substance use as using more than once within the past 30 days limits the ability to distinguish experimenters from regular users (Warner, 2016). Given the rising trend of e-cigarette use and shifting attitudes on marijuana use among youth, it is important to understand how current e-cigarette use is related to current marijuana use along with the risk factors associated with being a single or dual user of e-cigarettes and marijuana as well as the frequency of using e-cigarettes and marijuana. Learning these factors contributed to e-cigarette and marijuana use among youth could inform policy makers, school administrators and healthcare practitioners to formulate future regulations on e-cigarette and marijuana use and conduct educational campaigns to prevent youth from vaping and drug abuse

To fill the gaps in knowledge, we examined the factors associated with the use of e-cigarettes and marijuana among adolescents in 8th, 10th, and 12th graders by analyzing the data from the 2014 Monitoring the Future study. We specially sought to: 1) analyze the patterns of exclusive and dual-use of e-cigarette and marijuana among adolescents by grade: 2) assess social demographic factors associated with youth's use of e-cigarettes and marijuana; 3) examine the associations between other factors (i.e., school grade, number of days missed school, and students' working hours) and patterns of e-cigarette and marijuana use; 4) analyze risk factors associated with frequency of e-cigarette and marijuana use.

2. Methods

2.1. Data

This study used the data from 2014 Monitoring the Future study, a nationally representative sample of drug use among students in the United States. MTF has used questionnaires in the classroom to survey nearly 50,000 students from about 420 schools for 12th graders since 1975 and 8th and 10th graders since 1991 using a multistate, stratified research design. The details of study design can be found in other studies (Bachman, Johnston, O'Malley, & Schulenberg, 2011; Miech, O'Malley, et al., 2015b; Warner, 2016). A total of 41,551 students from 377 public and private secondary schools participated in the 2014 survey with response rates of 90%, 88%, and 82% for 8th, 10th, and 12th grade students, respectively. National weights were applied to each student record to account for the complex survey design and adjust for nonresponse. Because the data were de-identified and publically available, institutional review board (IRB) approval was exempt.

2.2. Measures

2.2.1. E-cigarette use (current use and frequency of use)

E-cigarette use was first reported in the 2014 MTF survey and we used the item below to define the current e-cigarette use: "During the LAST 30 DAYS, on how many occasions (if any) have you used electronic cigarettes (e-cigarettes)?" No e-cigarette users were defined as students who reported 0 days of using e-cigarettes in the last 30 days. Current e-cigarette users were defined as students who reported at least 1 time use of e-cigarettes in the last 30 days. We further categorized current e-cigarette users into low- (1–5 days), medium- (6–19 days) and high-level users (20–30 days).

2.2.2. Marijuana use (current use and frequency of use)

We used the item below to define current marijuana use: "On how many occasions (if any) have you used marijuana (grass, pot) or hashish (hash, hash oil)… during the last 30 days?" No marijuana users were students who reported 0 days. Current marijuana users were defined as students who reported at least 1 time use of marijuana in the last 30 days. We further categorized current marijuana users into low- (1–5 occasions), medium- (6–19 occasions) and high-level users (20+ occasions).

A total of 22,548 students were asked for both questions regarding e-cigarette and marijuana use. 6,364 students with missing answers were excluded, resulting in 16,184 respondents in the final study (4,315 8th graders, 4,077 10th graders and 7,792 12th graders).

2.2.3. Covariates

Several covariates were included in the analysis to control for other influences, such as age, sex (male or female), race/ethnicity (Black, White, Hispanic), grade (8th, 10th, or 12th grade with the typical age of 13, 15, 17 years old, respectively), father's education level (less than high school, high school, college or above), mother's education level (less than high school, high school, college or above), number of days missed in school due to illness during the last four weeks, number of days missed in school due to "skipped" or "cut" during last four weeks, school grade (C or below, B, A), hours worked in a paid or unpaid job (none, ≤5 h, 6–20 h, and 20+ h), and geographic residence (South, Northeast, Midwest and West). Since there is a high correlation between e-cigarette and traditional cigarette use among youth, (Krishnan-Sarin, Morean, Camenga, Cavallo, & Kong, 2015; Lee et al., 2015; Wills et al., 2015) we also included current tobacco smoking status as a covariate. The current tobacco smoking status was coded as never (students who have never smoked cigarettes), former (students who had smoked in their lifetime but not smoked in the past 30 days), and current smoker (students who have smoked in the past 30 days). Since the MTF study does not provide information on the number of