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Is Adolescent Poly-tobacco Use Associated with Alcohol and Other Drug Use?

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Abstract

Objectives—To examine associations between current multiple tobacco product use, and current use of alcohol and marijuana, binge drinking, and lifetime use of marijuana, alcohol, and other drugs among US high school students.

Methods—Using 2013 Youth Risk Behavior Survey data (N = 13,583 high school students), logistic regression analyses were conducted to determine if single tobacco product or multiple tobacco product users are more likely to engage in other risk behaviors than zero tobacco product users, controlling for demographic variables.

Results—Overall, 23% of the sample used tobacco products and 10% of students reported current use of at least 2 tobacco products. Among single tobacco product users, the odds for engaging in risk behaviors ranged from 3.3 to 9.9 compared to non-tobacco users ($p < .0001$). Among multiple tobacco product users, the odds ranged from 1.5 to 4.7 ($p < .01$) compared to single tobacco product users.

Conclusions—Results suggest dual users are significantly more likely to engage in risk behavior than non-users and single product users. Future interventions should consider identifying dual-users as at higher risk, and targeting multiple risk behaviors.

Keywords

adolescent tobacco use; multiple tobacco product use; alcohol use; drug use; risk behaviors

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Human Subjects Statement

These data were exempt from IRB approval, and are publically available from the US Centers of Disease Control and Prevention

Conflict of Interest Statement

The authors have no conflicts of interest to report.

Tobacco use among high school students poses a significant threat to public health in the United States (US) as nearly all tobacco use begins in adolescence.¹ Although traditional cigarette use among high school students has declined significantly, rates of dual use (concurrent use of cigarettes and other tobacco products) and nontraditional tobacco use (use of smokeless tobacco and other non-cigarette products) have increased.^{2,3} These trends may be attributed to dramatic changes in the tobacco marketplace occurring over the past decade, including the introduction of increasingly diverse products and flavorings that appeal to teens.⁴

High school student tobacco use patterns have changed considerably over the past decade.^{2,3,9} Tobacco use no longer solely consists of traditional cigarette use, but includes a plethora of non-cigarette products as well.^{2,9} Data from the Youth Risk Behavior Survey (YRBS), which has tracked high school students' use of cigarettes, cigars, and smokeless tobacco since the 1990s shows a steady decline in the individual use of these products since 1999.^{3,10} According to an analysis of the 2013 YRBS, the overall prevalence of high school students (grades 9–12) using 2 or more tobacco products was 2.5% in 2013.³ Among high school students who reported already being current tobacco users (23%, use of at least one tobacco product during the past 30 days), 11.8% also reported using 2 or more tobacco products concurrently in 2013.³

Adolescence is a critical developmental period characterized by profound changes in physical, emotional, and social development. Structural and functional changes in the developing brain create vulnerability for risk-taking and sensation-seeking behaviors. The experiences that teens have are important because neural pathways, which will endure throughout their lives, are established based on their experiences as youth.⁵

During adolescence, important patterns of behavior are established including tobacco, alcohol, and other substance use. Evidence suggests that health risk and health-promoting behaviors rarely occur in isolation, but instead, cluster.⁶ Other approaches to these behaviors assume that there are common genetic factors among teens who engage in risk behaviors.⁷ Early studies suggest that teen tobacco use is associated with other substance use including alcohol, marijuana, and cocaine, with the strongest body of evidence supporting an association between tobacco use and alcohol use.^{1,8} The 2012 Surgeon General's Report concluded that these studies are "suggestive but not sufficient to conclude that teen tobacco use contributes to future use of other substances such as marijuana and other illicit drugs."¹ However, few articles have examined the association between the use of multiple tobacco products and alcohol and other drug use.⁸

In light of the changing tobacco product landscape since the Master Settlement Agreement, more research is needed to determine whether high school students who use tobacco products are at a higher risk for other substance use, and whether users of multiple tobacco products are at a higher risk compared to single product users.¹ It is unknown if the changes in tobacco product prevalence, including use of more than one product, are due to substitutions for other tobacco products, or if multiple tobacco product use increases risk for other health-compromising behaviors. The purpose of this paper is to examine nationally representative data of US high school students, to determine if students who use one tobacco

product or more than one tobacco product (poly-tobacco use) are more likely to engage in other substance and alcohol use behaviors than non-users. It was hypothesized that students who used more than one tobacco product would be more likely to engage in behaviors related to alcohol and other drug use than students who use zero or one tobacco product.

METHODS

Study Design

The 2013 national YRBS data were used to answer study questions. The YRBS is a school-based biennial survey among high school students in public and private schools across the US conducted by the US Centers for Disease Control and Prevention (CDC). Data collected are self-reported and anonymous. The purpose of the YRBS is to determine the prevalence of multiple risk behaviors, including tobacco, alcohol, and other drugs, among adolescents.¹¹ The first national YRBS was conducted in 1991.

The methods employed for the YRBS survey have been reported previously.¹¹ A 3-stage cluster design was used to attain a nationally representative sample. The first stage categorized the primary sampling units (PSUs) by metropolitan status, percent of black and Hispanic students, urbanization, and other demographic factors. The second stage randomly sampled schools with any of the grades 9–12 from the PSUs. Lastly, one to 2 classrooms from each grade in each of the selected schools were selected. Blacks and Hispanics were over-sampled, and sampling weights were calculated to make the data nationally representative.¹¹ The inter-rater reliability of YRBS measures have been verified.¹² In 2013, data were collected from 13,583 students in 148 schools.¹³ The overall response rate (students and schools) was 68%.¹³

Measures and Data Management

Data, including formats, were downloaded as SAS files from the www.cdc.gov/yrbs website. Variables not related to these analyses were dropped from the dataset to create a working clean dataset. The primary tobacco variables were use of cigarettes (smoked cigarettes one day during the past 30 days), cigars, little cigars, and cigarillos (smoked cigars one day during the past 30 days), and smokeless tobacco (used smokeless tobacco one day during the past 30 days). Persons were coded as tobacco “users” for these products if they indicated they had used in the past 30 days. Students were categorized into 3 groups: no tobacco use; current (past 30 day) users of one tobacco product; and current users of more than one tobacco product. Those in the “no tobacco use” category reported using cigarettes, smokeless tobacco, and cigars on zero of the last 30 days. Those in the “one tobacco product” user group reported using cigarettes, smokeless tobacco, or cigars on at least one day in the past 30 days. Students in the “more than one tobacco product” category reported using at least 2 tobacco products (cigarettes, smokeless tobacco, or cigars) on at least one day in the past 30 days.

Variables related to alcohol and other drug use were age of first use of alcohol and marijuana; binge drinking (5 or more drinks of alcohol in a row within a couple of hours); lifetime use (ie, ever use) of marijuana, alcohol, cocaine, glue as an inhalant, heroin,

methamphetamines, ecstasy, prescription drugs, and hallucinogenic drugs; and current use (ie, past 30 day use) of alcohol and marijuana. The survey is available online at <http://www.cdc.gov/healthyyouth/data/yrbs/data.htm>. For all variables, responses were dichotomized. Current use was coded as “yes” if respondents selected at least one day as their response option; lifetime use was coded as “yes” if respondents indicated they had used the drug or alcohol at least once in their life; for age at first use, responses were coded as “before age 13” if respondents reported “12 or younger.”

Socio-demographic variables of interest were sex (boy or girl), race/ethnicity (white, non-Hispanic; black, non-Hispanic; Hispanic; other), and grade (9th, 10th, 11th, or 12th).

Analyses

The research questions addressed in this study were: (1) Are students who use tobacco products more likely to engage in risk behaviors such as alcohol, marijuana, and other drugs than students who do not use tobacco products? and (2) Are students who use more than one tobacco product more likely to engage in risk behaviors such as alcohol, marijuana, and other drugs than students who use one tobacco product or no tobacco products? All analyses were conducted using SAS version 9.3 (Cary, NC).

To determine if students who use tobacco products were at increased likelihood for other health-compromising (risk) behaviors than non-users, logistic regression was conducted, with non-users of tobacco as the referent group. To determine if students who use more than one tobacco product were more likely than users of one tobacco product to engage in other health-compromising behaviors, logistic regression analyses were conducted with users of one tobacco product as the referent group. Separate logistic regression analyses were run for each alcohol- and drug-related variable. For each logistic regression, the alcohol- or drug-related variable was the dependent (ie, outcome) variable, and tobacco use was the independent (ie, predictor) variable. All logistic regression analyses were controlled for grade, sex, and race/ethnicity; these were added as covariates to the regression models. The alpha level for each regression was set at the default of .05. Probability values (p) for each odds ratio were calculated using the LSMEANS option under the PROC SURVEYLOGISTIC procedure. All analyses used available sampling weights to ensure the estimates were nationally representative.

RESULTS

Among high school students, in 2013, 77% did not use any tobacco products, 13% used one tobacco product, and 10% used more than one tobacco product. One of the most common other behaviors among all categories of tobacco use was lifetime marijuana use, with 87% of users of more than one tobacco product reporting lifetime marijuana use (Table 1). Current marijuana use, lifetime drinking, and current drinking were the other most common behaviors among multiple tobacco users.

Students who currently used one tobacco product or more than one tobacco product were at increased odds for all other behaviors than students who currently used zero tobacco products ($p < .0001$) (Table 2). Among students who used one tobacco product, the odds for

all other behaviors ranged from 3.3 to 9.9. For example, for students who used one tobacco product, the odds of ever having a drink of alcohol were 9.9 times (95% confidence interval: 7.4, 13.1, $p < .0001$) greater than for students who did not use any tobacco product, when adjusting for sex, grade, and race/ethnicity. Among students who used more than one tobacco product, the odds for all other behaviors ranged from 5.0 to 29.2. For example, for students who used more than one tobacco product, the odds of ever having drunk alcohol and ever used methamphetamines were 29.2 times (95% confidence interval: 17.0, 50.0; $p < .0001$) and 28.9 times (95% confidence interval: 17.2, 48.7; $p < .0001$), respectively, than for students who currently used zero tobacco products, when adjusting for sex, grade, and race/ethnicity.

Students who currently used *more than one* tobacco product were at increased odds for all other behaviors compared to students who used one tobacco product ($p < .01$) (Table 3). Among students who used more than one tobacco product the odds for all other behaviors ranged from 1.5 to 4.7. For example, for students who used more than one tobacco product, the odds of ever using heroin were 4.7 times (95% confidence interval: 3.0, 7.5; $p < .0001$) than for students who currently used one tobacco product, when adjusting for sex, grade, and race/ethnicity.

DISCUSSION

This paper describes the association between multiple tobacco product use and alcohol and other drug use, for a nationally representative sample of high school students. This study suggests students who use multiple tobacco products (at least 2) are significantly more likely to use other drugs than students who use zero tobacco products or one tobacco product, which supports the hypothesis of this study. Additionally, these results reinforce prior studies and theory which indicate that health risk behaviors rarely occur individually.^{6,14–18} Importantly, in addition to the current study, previous studies suggest that dual users are at a greater risk for other substance use and health problems than either non-users or single product users.^{16–18}

These results reinforce the results from an earlier study of 1997 YRBS data in which students who used cigarettes, cigars, and smokeless tobacco were 52 times as likely to be current users of alcohol, 31 times as likely to be current users of marijuana, and 84 times as likely to be current users of cocaine compared to non-users of tobacco products.⁸ The current study did not distinguish among types of multiple tobacco product use (such as cigarettes plus cigars, or cigars plus smokeless tobacco); however, similar patterns of increased risk were detected for alcohol, marijuana, and cocaine use when 2 or more tobacco products were used. Additionally, the current study examined lifetime use of additional drugs that were not included in the 1997 YRBS, such as heroin, methamphetamines, ecstasy, hallucinogenic drugs, and prescription drugs, with consistently increased use of these substances among multiple tobacco product users. The data represented in the aforementioned study were collected prior to the Master Settlement Agreement, and the point prevalence of individual tobacco product use was highest in 1997.⁸ Therefore, it is important to extend the results to examine what is currently ongoing, due to the changing environment of tobacco use among youth. The findings in this study are noteworthy as no other study

since 1997 has examined and confirmed the risks of greater alcohol and drug use by multiple tobacco product use.

Strengths and Limitations

The data in this study are nationally representative. However, they are not without limitations. A limitation of the survey is that many of the other drugs, except marijuana, are only asked as *ever use*, not *current use*. Therefore, it is possible that ever use of drugs occurred prior to tobacco use. Additionally, causal inference is not possible because these data are cross-sectional. Whereas the data are self-reported, there is evidence that these measures are reliable.¹² Dual use is defined differently across studies, which makes it difficult to compare results, particularly when comparing national prevalence data. For example, dual use may refer to daily use or non-daily use of 2 or more products. Lastly, the YRBS only asks about cigarettes, cigars, and smokeless tobacco, which are no longer the 3 most commonly used tobacco and nicotine products among adolescents.⁹ However, there is evidence that multiple tobacco product use of traditional tobacco products is still common.^{1,3} The 2015 YRBS survey will ask about electronic cigarette use, and this will add greatly to our understanding of how new and emerging tobacco products affect participation in using multiple tobacco products as well as other risk behaviors.

Implications for Practice and Research

This study provides important information regarding tobacco use, specifically multiple tobacco product use, and its association with alcohol and other drug use. This study confirms that behaviors rarely occur in isolation and that health-compromising behaviors, including tobacco and other drug use, tend to cluster. Intervention programs should target multiple risk behaviors, for example, by including skills training for adolescents around multiple tobacco products, alcohol, and other drug use.¹⁹ Study results echo previous studies that have demonstrated important relationships between dual tobacco use and alcohol, illicit drugs, and increased risk for other health conditions.^{16–18} Therefore, identifying these dual and multiple product users for intervention of other risk behaviors is essential, because these high school students appear to be at particularly high risk. Additionally, multi-component prevention programs not only should focus on cigarette smoking, but also on the use of multiple tobacco products, particularly in light of this increased risk. Furthermore, with the increasing diversity of the tobacco and nicotine product landscape, there is a need to study new and emerging products. Are students who use these products more likely to engage in other risk behaviors?

Future research should examine demographic characteristics, such as sex, socio-economic status, urbanicity associated with increased risk for dual tobacco product use, as dual use is a potential gateway to other substance use. Identification of important demographic risk factors can assist in distinguishing youth with increased risk for dual use of tobacco products, substance use, and other health problems, and where to target prevention efforts. Additionally, it is unknown if specific combinations of tobacco and nicotine products increase risk; this study was limited by the small number of tobacco product users. Therefore, risk was not calculated according to specific combinations of dual or multiple product use. Lastly, longitudinal research can help to explain the temporality of these

relationships, point to causal associations, and help to identify other underlying factors associated with these behaviors.⁷

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Table 1

Prevalence of Alcohol and Other Drug Behaviors, by Tobacco Use Status

	Overall Sample N = 13,533	Use of Zero Tobacco Products ^a (Past 30 days) N = 10,580	Use of One Tobacco Product ^a (Past 30 days) N = 1728	Use of More than One Tobacco Product ^a (Past 30 days) N = 1417
Lifetime Drinking^b	66.2%	57.6%	93.1%	97.3%
First drink <13	20.8%	13.5%	30.6%	40.4%
Current Drinking^c	34.9%	22.9%	70.4%	85.8%
Binge Drink^d	18.6%	10.4%	47.6%	70.2%
First marijuana <13	8.6%	4.2%	19.6%	28.4%
Lifetime marijuana use^b	40.7%	28.5%	77.0%	87.3%
Current marijuana use^c	23.4%	13.0%	53.6%	64.5%
Lifetime cocaine^b	5.5%	1.9%	11.9%	24.3%
Lifetime sniffed glue^b	8.9%	5.6%	15.1%	26.0%
Lifetime heroin^b	2.2%	0.6%	2.9%	12.8%
Lifetime methamphetamine^b	3.2%	0.8%	6.8%	16.0%
Lifetime ecstasy^b	6.6%	2.4%	15.2%	26.6%
Lifetime prescription drugs^b	17.8%	9.7%	38.5%	52.5%
Lifetime hallucinogenic drugs^b	7.1%	2.4%	16.9%	29.2%

Note.

^aTobacco products: cigarettes, cigars, smokeless tobacco

^bEver use of the product

^cPast 30 day use

^d5 or more drinks, in a row, within a couple of hours

Odds of Alcohol and Other Drug Use Among Tobacco Users Compared to Current Users of Zero Tobacco Products, by Current Tobacco Use Status^c

Table 2

	Current Use of 0 tobacco products ^d (reference group)			Current use of one tobacco product ^d			Current use of more than one tobacco product ^d		
	Odds Ratio	Odds Ratio	95% CI	Odds Ratio	95% CI	p-value	Odds Ratio	95% CI	p-value
Lifetime Drinking ^b	1.0	9.9	7.4, 13.1	29.2	17.0, 50.0	<.0001			
First drink <13	1.0	3.3	2.7, 4.0	5.0	4.2, 6.0	<.0001			
Current Drinking ^c	1.0	8.1	6.5, 10.0	22.7	17.5, 29.4	<.0001			
Binge Drink ^d	1.0	7.5	6.2, 9.0	21.0	16.8, 26.3	<.0001			
First marijuana <13	1.0	7.1	5.6, 9.0	11.8	9.5, 14.6	<.0001			
Lifetime marijuana use ^b	1.0	9.5	7.9, 11.5	21.2	17.5, 25.7	<.0001			
Current marijuana use ^c	1.0	9.1	7.6, 11.0	15.7	12.1, 20.4	<.0001			
Lifetime cocaine ^b	1.0	7.4	6.0, 9.2	17.6	14.5, 21.5	<.0001			
Lifetime sniffed glue ^b	1.0	3.4	2.7, 4.3	7.1	5.8, 8.6	<.0001			
Lifetime heroin ^b	1.0	6.1	3.6, 10.4	28.9	17.2, 48.7	<.0001			
Lifetime methamphetamine ^b	1.0	9.5	6.5, 13.8	24.5	17.7, 34.0	<.0001			
Lifetime ecstasy ^b	1.0	8.2	6.4, 10.3	16.2	12.4, 21.2	<.0001			
Lifetime prescription drugs ^b	1.0	6.0	5.1, 7.0	10.8	9.1, 12.7	<.0001			
Lifetime hallucinogenic drugs ^b	1.0	8.6	6.2, 12.0	16.5	11.3, 24.2	<.0001			

Note.

^aTobacco products: cigarettes, cigars, smokeless tobacco

^bEver use of the product

^cPast 30 day use

^d5 or more drinks, in a row, within a couple of hours

Table 3
Odds of Alcohol and Other Drug Use Compared to Current Users of One Tobacco Product, by Current Tobacco Use Status^c

	Current Use of 0 tobacco products ^d			Current use of one tobacco product ^d (reference group)			Current use of more than one tobacco product ^d		
	Odds Ratio	95% CI	p-value	Odds Ratio	95% CI	p-value	Odds Ratio	95% CI	p-value
Lifetime Drinking ^b	0.1	0.1, 0.1	<.0001	1.0			3.0	1.5, 5.8	0.002
First drink <13	0.3	0.3, 0.4	<.0001	1.0			1.5	1.3, 1.8	<.0001
Current Drinking ^c	0.1	0.1, 0.2	<.0001	1.0			2.8	2.2, 3.6	<.0001
Binge Drink ^d	0.1	0.1, 0.2	<.0001	1.0			2.8	2.2, 3.6	<.0001
First marijuana <13	0.1	0.1, 0.2	<.0001	1.0			1.7	1.4, 2.0	<.0001
Lifetime marijuana use ^b	0.1	0.1, 0.1	<.0001	1.0			2.2	1.8, 2.8	<.0001
Current marijuana use ^c	0.1	0.1, 0.1	<.0001	1.0			1.7	1.4, 2.1	<.0001
Lifetime cocaine ^b	0.1	0.1, 0.2	<.0001	1.0			2.4	1.9, 3.0	<.0001
Lifetime sniffed glue ^b	0.3	0.2, 0.4	<.0001	1.0			2.1	1.6, 2.8	<.0001
Lifetime heroin ^b	0.2	0.1, 0.3	<.0001	1.0			4.7	3.0, 7.5	<.0001
Lifetime methamphetamine ^b	0.1	0.1, 0.2	<.0001	1.0			2.6	2.1, 3.2	<.0001
Lifetime ecstasy ^b	0.1	0.1, 0.2	<.0001	1.0			2.0	1.5, 2.6	<.0001
Lifetime prescription drugs ^b	0.2	0.1, 0.2	<.0001	1.0			1.8	1.5, 2.2	<.0001
Lifetime hallucinogenic drugs ^b	0.1	0.1, 0.2	<.0001	1.0			1.9	1.5, 2.6	<.0001

Note.

^aTobacco products: cigarettes, cigars, smokeless tobacco

^bEver use of the product

^cPast 30 day use

^d5 or more drinks, in a row, within a couple of hours