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Simultaneous Alcohol and Marijuana Use among Underage Young Adults in the United States

Megan E. Patrick, PhD[1,a], **Yvonne M. Terry-McElrath, MSA**[2], **Christine M. Lee, PhD**[3], and **John E. Schulenberg, PhD**[2,4]

[1]Institute for Translational Research in Children's Mental Health, Institute of Child Development, University of Minnesota

[2]Institute for Social Research, University of Michigan

[3]Center for the Study of Health Risk Behaviors, Department of Psychiatry and Behavioral Sciences, University of Washington

[4]Department of Psychology, University of Michigan

Abstract

Objective—The current study examines the prevalence, stability, and correlates of simultaneous alcohol and marijuana (SAM) use among underage US young adults, a population at high risk for participating in this behavior.

Method—Analyses used data from 1,719 respondents (46.8% men) who participated in the nationally representative 12th-grade Monitoring the Future study and provided responses to SAM use items at longitudinal follow-up at modal ages 19/20 between 2007 and 2016. Prevalence estimates and covariate associations with SAM use were estimated.

Results—SAM use prevalence at modal age 19/20 was 22.5%. Multivariable models indicated that odds of age 19/20 SAM use were significantly ($p<.05$) higher for men (vs. women) and for respondents who started alcohol use by age 18 (vs. those who delayed uptake until after high school). Odds of SAM use were especially high for individuals attending college full-time and not living with parents. Among those who reported SAM use at modal age 18, 56.2% continued to report SAM use at modal age 19/20. Among those who did not report SAM use at modal age 18, only 14.2% reported SAM use at modal age 19/20.

Conclusions—SAM use among young adults aged 19/20 in the US is relatively common, but especially so for those who began such use by age 18, highlighting the early onset and stability of this behavior. Among underage drinkers, SAM risk varies by sex, race/ethnicity, college status, and living arrangements.

[a]Corresponding Author. Megan E. Patrick, Ph.D., Institute for Translational Research in Children's Mental Health, University of Minnesota, 1100 Washington Avenue S, Suite 101, Minneapolis, MN 55414. Telephone 612-625-9214; mpatrick@umn.edu.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Simultaneous alcohol and marijuana (SAM) use, defined as using at the same time so that the effects overlap, is associated with increased risk of serious public health concerns (e.g., unsafe driving) compared with marijuana use alone or with concurrent marijuana and alcohol use without overlapping effects (Agosti et al., 2002; Arterberry et al., 2017; Earleywine and Newcomb, 1997; Hartman and Huestis, 2013; Lee et al., 2017; Lipperman-Kreda et al., 2017; Martin et al., 1996; Midanik et al., 2007; Subbaraman and Kerr, 2015; Terry-McElrath et al., 2014; Yurasek et al., 2017). SAM use prevalence is highest in young adulthood (Midanik, et al., 2007; Norton and Colliver, 1988; Subbaraman and Kerr, 2015), a period also associated with increased substance use generally (Bachman et al., 1997; Patrick and Terry-McElrath, 2017; Schulenberg et al., 2017; Schulenberg and Maggs, 2002). Individuals transitioning from high school are at highest risk for SAM use (Terry-McElrath and Patrick, 2016) but little is known about SAM use in this key subpopulation. Studies have not yet examined the extent to which high school SAM and non-SAM users continue or initiate SAM use during young adulthood.

Also, little is known about what places young adults at higher SAM use risk. Adolescent SAM use is more likely for boys than girls, teens whose parents have at least some college education (a proxy for socioeconomic status), and teens who plan to graduate from college, but results regarding race/ethnicity are mixed (Briere et al., 2011; Collins et al., 1998; Hoffman et al., 2000; Lipperman-Kreda, et al., 2017; Patrick et al., 2017a). Adolescent SAM use also is more likely for teens who report binge drinking, defined as having five or more drinks during a single drinking episode (Patrick et al., 2017c). Studies examining SAM use correlates among adults have included combined adolescent/adult samples (Barnwell and Earleywine, 2006; Norton and Colliver, 1988), college students (Arterberry, et al., 2017), individuals in their late 20s-early 30s (Earleywine and Newcomb, 1997), and adults overall (Höhne et al., 2014; Midanik, et al., 2007; Subbaraman and Kerr, 2015). These adult studies show mixed results regarding SAM use likelihood based on sex, race/ethnicity, income, employment, and educational attainment. Among college students, SAM use was more likely for men than women and those with lower college grades, with no differences based on race/ethnicity (Arterberry, et al., 2017). Recognized predictors of young adult overall alcohol use and marijuana use may also be associated with young adult SAM use, such as gender, race/ethnicity, socioeconomic status, age of initiation, college status, living situation, and employment (Chen et al., 2017; NIAAA, 2005; Patrick and Terry-McElrath, 2017; Richmond-Rakerd et al., 2017; SAMHSA, 2017a, 2017b; Schulenberg et al., 2017; Terry-McElrath et al., 2017).

The Current Study

The current study uses national samples of US young adults under the legal drinking age to investigate two research aims: (1) Estimate prevalence and within-person stability in SAM use from modal ages 18 through 19/20; and (2) Examine characteristics measured at modal ages 18 and 19/20 associated with high odds of young adult SAM use.

Method

Sample

Monitoring the Future (MTF; Miech et al., 2017; Schulenberg, et al., 2017) annually surveys approximately 15,000 high school seniors (modal age 18) in about 130 schools. About 2,400 students are selected annually for longitudinal follow-up (oversampling substance users, accounted for in weighted analyses), half of whom begin biennial follow-up one year later (model age 19), the other random half two years later (modal age 20). The current study includes respondents in 12th-grade cohorts from 2005 through 2015; age 19/20 data were collected in 2007–2016. The university Institutional Review Board approved the study.

Simultaneous alcohol and marijuana (SAM) use questions were included on a random sixth of 12th-grade questionnaires, completed by 4,004 high school seniors from the relevant cohorts selected for follow-up. Of these, 1,892 individuals (47.3%) responded to follow-up at modal age 19/20; 25 were excluded from analyses because they were 21 years or older or were missing data to confirm age and 150 were removed due to missing or inconsistent data on SAM use. The total analytical sample included 1,719 respondents. We combined cases available for analysis at modal age 19 or 20 in order to have an adequate sample size to examine covariate associations (such as with racial/ethnic categories).

Measures

Simultaneous alcohol and marijuana use.—Respondents who self-reported past 12-month alcohol and marijuana use were asked, “How many of the times when you used marijuana or hashish during the last year did you use it along with alcohol—that is, so that their effects overlapped?” Responses were coded as any or no SAM use (the latter including no past 12-month marijuana use).

Age 18 covariates included gender (male, female), race/ethnicity (White, Black, Hispanic, or Other [combined due to sample size limitations]), parental education (at least one parent graduated from college, not), grade of first alcohol use (before high school [grades 1- 8], during high school [grades 9-12], or after high school), and prevalence of binge drinking ([5+ drinks in a row in the past two weeks] any, none).

Age 19/20 covariates.—Follow-up occurred at modal age 19 or 20 (coded as 0 or 1, respectively). College status combined information on (a) 2- or 4-year college and (b) full-time attendance or less, resulting in a categorical measure of full-time at a 4-year college, full-time at a 2-year college, part-time/other at any type of college, or not attending college. Living with parents was coded as yes (1) or no (0). Employment during the first full week in March was coded as yes (at least a part-time job) or no. Year of data collection was coded using dichotomous year indicators.

Data Analysis

All analyses were conducted with SAS 9.4. The relationship between age 18 and 19/20 categorical SAM use was examined with PROC SURVEYFREQ. Bivariate and multivariable models regressing age 19/20 SAM use on covariate(s) were estimated with

PROC SURVEYLOGISTIC. All analyses used attrition weights, calculated as the inverse of the probability of participation and based on the following age-18 covariates: gender, race/ethnicity, college plans, high school grades, number of parents in the home, religiosity, parental education, alcohol use, cigarette use, marijuana use, geographic region, cohort, and the sampling weight accounting for oversampling of substance users. Missing data on covariates were modeled by coding all covariates as categorical with a separate category identifying cases with missing data; thus, analyses included all possible cases.

Results

SAM prevalence and stability from ages 18 through 19/20 (Research Aim [RA] 1)

From 2007 to 2016, average modal age 18 prevalence levels were as follows: 19.8% (95% CI 17.8, 21.9) reported any SAM use within the past 12 months; 11.7% (95% CI 9.9, 13.5) reported past 12-month concurrent use of alcohol and marijuana without simultaneous use; 32.7% (95% CI 30.3, 35.2) reported past 12-month use of alcohol but not marijuana; and 1% (95% CI 0.3, 1.5) reported past 12-month use of marijuana but not alcohol. At (modal) age 19/20, an average of 22.5% (95% CI 20.4, 24.6) of young adults reported any SAM use within the past 12 months. Approximately one in 10 (10.6% [95% CI 9.0, 12.2]) reported concurrent use of alcohol and marijuana without simultaneous use; 38.0% (95% CI 35.5, 40.5) reported use of alcohol but not marijuana; and 1% (95% CI 0.5, 1.6) reported use of marijuana but not alcohol.

Among respondents who *did report* SAM use at age 18, 56.2% (95% CI 50.4, 62.1) continued to report SAM use at age 19/20. Of those who *did not report* any SAM use at age 18, 14.2% (95% CI 12.2, 16.2) reported SAM use at age 19/20. At a population level, the strong bivariate association between age 18 and age 19/20 SAM use (OR=7.79 [5.80, 10.45], $p<.001$) indicates notable stability in SAM use between 12^{th} grade and one to two years post-high school, suggesting that the onset of most of this rather stable behavior occurs prior to the end of high school.

Characteristics associated with high odds of SAM use at age 19/20 (RA 2)

Table 1 provides covariate descriptive statistics. Table 2 presents both bivariate and multivariable associations between covariates (controlling for age 18 SAM use) and the odds of any past 12-month SAM use at age 19/20. Age 18 SAM use remained significantly and positively associated with SAM use at age 19/20 both before and after controlling for covariates. In both bivariate and multivariable models, the odds of SAM use were significantly higher for men (vs. women), those who first used alcohol during high school (vs. after high school), those who reported binge drinking at age 18, and those not living with parents at age 19/20 (vs. living with parents). In bivariate but not multivariable models SAM use at age 19/20 was higher for White respondents (vs. Black or Hispanic respondents) and individuals attending a 2-year college full-time (vs. those not in college).

Interaction between full-time college status and living with parents (all other covariates included) was significant ($p<05$). Among those attending a 4-year college full-time, the odds of SAM use were significantly higher for those not living (vs. living) with parents (28.7%

vs. 11.8%; AOR 2.87 [95% CI 1.63, 5.04], p=0.0003). Among those not attending a 4-year college full-time, living with parents was not significantly associated with SAM use prevalence.

Discussion

Using a national sample of US young adults below the legal drinking age, the current study found that more than one in five individuals at age 19/20 reported past 12-month simultaneous alcohol and marijuana (SAM) use. Over half of those who reported SAM use at age 18, compared with only 15% of non-SAM users at age 18, continued to report SAM use at age 19/20, showing considerable individual-level stability across the one to two years following high school. Characteristics significantly associated with SAM use risk at age 19/20 included sex, race/ethnicity, age of first use of alcohol, binge drinking at age 18, and (particularly for those attending a 4-year college full-time) living arrangements.

From 2007 to 2016, the prevalence of age 19/20 alcohol use decreased significantly (Patrick et al., 2017b; Schulenberg et al., 2017) but marijuana use increased (Schulenberg et al., 2017). The current study shows that SAM use at age 19/20 did not follow alcohol's historically decreasing pattern, instead remaining generally stable from 2007 to 2016. Increased marijuana use during these years may have affected use norms, so that while the total number of underage drinkers decreased, more of those who drank participated in SAM use, thereby keeping the overall prevalence of SAM use stable across the past decade (Terry-McElrath and Patrick, 2016). Underage drinkers may be substituting SAM use for binge drinking (5+ and per occasion) and high-intensity drinking (10+ drinks per occasion; Patrick, 2016; Patrick and Azar, 2017) to varying degrees, as both binge and high-intensity drinking have also declined over the past decade (Patrick et al., 2017b).

The current study extended available research on the stability of and characteristics associated with SAM use during the transition from high school into young adulthood. High levels of continuity at the population level and stability at the individual level indicate that high school is a key period for the establishment of SAM use and thus of particular relevance for SAM prevention efforts. Consistent with the Arterberry et al. (2017) study conducted at one university, our results show significantly higher SAM use among men compared with women; however, in contrast to their findings, the current national-level study shows significantly higher SAM use among White than Black underage young adults (further analyses on past 12-month alcohol or marijuana use not showing significant differences between White and Black respondents). Underage young adults attending college full-time and not residing with parents are at especially elevated risk for SAM use, as is the case with other risky alcohol use behaviors like high-intensity drinking (Patrick and Terry-McElrath, 2017). Thus, specific population subgroups may particularly benefit from prevention programming that includes accurate and relevant information on the risks associated with SAM use both during high school and in the years immediately following. Other within-person research indicates that, among young adults, higher perceived risk of SAM use is associated with lower use of marijuana on days with a greater number of drinks (Yeomans-Maldonado and Patrick, 2015).

Study limitations include self-reported data, attrition, and high school student samples. Results may not generalize to the full population because high school dropout is associated with alcohol and marijuana use (Tice et al., 2017). Data were available only on the prevalence, not frequency, of SAM use. Investigation of frequency of use as well as SAM use among more diverse samples would be informative, as would studies that examine SAM use further into young adulthood. Future research investigating the extent to which changes in environmental factors such as state-level marijuana policy may affect the likelihood of reporting SAM use would also be informative.

Conclusions

One in five young adults aged 19/20 in the US engage in past-year SAM use. SAM use is especially common among those who were SAM users in 12th grade, with over half continuing this behavior during the one to two years following high school. It is more common among males than females, White than Black youth, and college students living away from home. Evidence suggests that high school is a key period for the establishment of SAM use that continues into young adulthood.

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Highlights

- 22.5% of 19/20 year-olds report simultaneous alcohol and marijuana (SAM) use in the past year.
- Odds of SAM use are higher for men and full-time college attenders not living with parents.
- Most (56.2%) who report SAM use at age 18 continue SAM use at age 19/20.
- Few (14.2%) report SAM use at age 19/20 if they did not at age 18.

Table 1.

Covariate Descriptives

	%[a]	(SE)		%	(SE)
Covariates measured at age 18					
Sex			Grade of first alcohol use		
Female	53.2	(1.13)	After high school	25.7	(1.27)
Male	46.8	(1.13)	During high school	48.0	(1.35)
Race/ethnicity			Before high school	19.0	(1.01)
Black	9.5	(1.11)	Missing indicator	7.4	
White	61.8	(1.71)	Binge drinking[c]		
Hispanic	15.6	(1.34)	None	81.8	(1.02)
Other	11.2	(0.92)	Any	16.8	(0.97)
Missing indicator[b]	1.9		Missing indicator	1.4	
Parental education					
No college degree	44.5	(1.48)			
College degree for 1+parents	51.4	(1.51)			
Missing indicator	4.1				
Covariates measured at age 19/20					
Years after high school			Living situation		
Modal age 19	53.5	(1.21)	Not living with parents	48.1	(1.56)
Modal age 20	46.5	(1.21)	Living with parents	51.6	(1.56)
College status			Missing indicator	0.3	
Not in college	25.2	(1.30)	Employment		
Part-time/other	11.3	(0.98)	Not employed	39.1	(1.28)
Full-time (2-year college)	18.2	(1.10)	Employed	57.4	(1.34)
Full-time (4-year college)	43.9	(1.48)	Missing indicator	3.6	
Missing indicator	1.4				

Notes: N(unweighted) = 1,719. Covariates also included year of data collection at age 19/20. Missing data on covariates modeled with missing data indicators as shown.

[a]Unadjusted weighted percentage.

[b]Missing indicators identify the percentage of the sample with missing data on the noted measure; these cases were included in relational analyses by use of a separate categorical indicator.

[c]Binge drinking defined as having 5 or more drinks in a row in the past two weeks.

Table 2.

Associations between covariates and any past 12-month simultaneous alcohol and marijuana use among young adults age 19/20, United States

	Simultaneous Alcohol and Marijuana Use at Age 19/20						
	%[a]	OR[b]	(95% CI)	*p*	AOR[c]	(95% CI)	*p*
Covariates measured at age 18							
SAM use in past 12 months at age 18							
None	14.2	(ref)			(ref)		
Any	56.2	7.79	**(5.80, 10.45)**	**<.0001**	**4.62**	**(3.28, 6.49)**	**<.0001**
Sex							
Female	18.8	(ref)			(ref)		
Male	26.7	**1.57**	**(1.24, 1.99)**	**0.0002**	**1.48**	**(1.12, 1.97)**	**0.0065**
Race/ethnicity							
Black	12.7	**0.44**	**(0.24, 0.78)**	**0.0054**	0.80	(0.42, 1.52)	0.4885
White	25.0	(ref)			(ref)		
Hispanic	18.1	**0.66**	**(0.44, 1.00)**	**0.0481**	0.82	(0.51, 1.32)	0.4115
Other	21.6	0.83	(0.55, 1.25)	0.3603	0.82	(0.50, 1.33)	0.4174
Parental education							
No college degree	21.1	(ref)			(ref)		
College degree for 1+parents	23.9	1.18	(0.92, 1.51)	0.1977	1.07	(0.78, 1.46)	0.6977
Grade of first alcohol use							
After high school	3.6	**0.09**	**(0.05, 0.14)**	**<.0001**	0.16	**(0.09, 0.27)**	**<.0001**
During high school	30.1	(ref)			(ref)		
Before high school	33.0	1.14	(0.85, 1.55)	0.3785	0.90	(0.63, 1.26)	0.5266
Binge drinking in past 2 weeks at age 18							
None	16.5	(ref)			(ref)		
Any	51.4	**5.38**	**(4.00, 7.23)**	**<.0001**	**2.30**	**(1.61, 3.28)**	**<.0001**
Covariates measured at age 19/20							
Years after high school							
Modal age 19	20.8	(ref)			(ref)		
Modal age 20	24.5	1.24	(0.97, 1.58)	0.0838	1.18	(0.88, 1.58)	0.2611
College status							
Not in college	23.9	(ref)			(ref)		
Part-time/other	22.7	0.94	(0.59, 1.50)	0.7885	1.08	(0.59, 1.99)	0.7943
Full-time (2-year college)	17.1	**0.66**	**(0.44, 0.98)**	**0.0384**	0.77	(0.50, 1.19)	0.2352
Full-time (4-year college)	24.2	1.02	(0.76, 1.37)	0.9100	1.24	(0.85, 1.79)	0.2602
Living situation							
Not living with parents	27.2	(ref)			(ref)		
Living with parents	18.1	**0.59**	**(0.46, 0.76)**	**<.0001**	**0.62**	**(0.45, 0.86)**	**0.0040**

	Simultaneous Alcohol and Marijuana Use at Age 19/20						
	%[a]	**OR**[b]	**(95% CI)**	***p***	**AOR**[c]	**(95% CI)**	***p***
Employment							
Not employed	22.8	(ref)			(ref)		
Employed	23.1	1.02	(0.79, 1.31)	0.8726	0.97	(0.71, 1.34)	0.8668
Year of data collection[d]							
2007	20.4	1.01	(0.56, 1.84)	0.9645	0.72	(0.37, 1.42)	0.3478
2008	25.7	1.37	(0.75, 2.49)	0.3031	0.98	(0.50, 1.94)	0.9578
2009	23.1	1.18	(0.67, 2.09)	0.5580	0.94	(0.49, 1.83)	0.8646
2010	19.1	0.98	(0.53, 1.78)	0.9346	0.68	(0.34, 1.37)	0.2829
2011	27.5	1.49	(0.80, 2.78)	0.2047	1.09	(0.54, 2.20)	0.8028
2012	25.2	1.33	(0.75, 2.35)	0.3231	0.95	(0.48, 1.86)	0.8765
2013	22.5	1.14	(0.63, 2.07)	0.6558	0.81	(0.41, 1.60)	0.5497
2014	24.0	1.25	(0.65, 2.38)	0.5046	1.16	(0.55, 2.47)	0.6950
2015	16.9	0.80	(0.43, 1.50)	0.4886	0.75	(0.35, 1.58)	0.4429
2016	20.2	(ref)			(ref)		

Notes: Total N (unweighted): 1,719. Missing data on non-outcome measures handled with the use of missing data indicators (estimates for missing data indicators not shown). Text in bold indicates results significant at $p < 0.05$.

[a] Unadjusted weighted percentage.

[b] OR = Bivariate odds ratio.

[c] AOR = Adjusted odds ratio from multivariable analysis.

[d] Additional bivariate and multivariable models were run wherein year was modeled using a linear term, as well as both linear and quadratic terms. Neither linear nor quadratic terms were significant in these models.