Alcohol or Marijuana First? Correlates and Associations With Frequency of Use at Age 17 Among Black and White Girls

CAROLYN E. SARTOR, PH.D.,^{a,*} ALISON E. HIPWELL, PH.D., CLIN.PSY.D.,^b & TAMMY CHUNG, PH.D.^b

^a*Department of Psychiatry, Yale University School of Medicine, New Haven, Connecticut*

^b*Department of Psychiatry, University of Pittsburgh, Pittsburgh, Pennsylvania*

ABSTRACT. Objective: Black youth are more likely than White youth to deviate from the typical sequence of initiating alcohol use before marijuana use. Although potentially informative for prevention efforts, sources of variation in the sequence of alcohol relative to marijuana use initiation and associations of initiation patterns with frequency of use have rarely been examined. **Method:** Data were drawn from 2,166 Pittsburgh Girls Study participants (56.9% Black, 43.1% White), collected at ages 11–17. Multinomial logistic regression analyses were conducted to identify distinctions by race and associations of socioeconomic, neighborhood, psychosocial, and psychiatric factors with alcohol and marijuana initiation patterns: alcohol first as “typical,” with “atypical” including both at the same age, marijuana first, marijuana only, and alcohol only. Separate ordinal logistic regression analyses were conducted to predict frequency of alcohol and marijuana use at age 17 as a function

of initiation pattern and significant correlates. **Results:** Black girls were overrepresented in the atypical initiation patterns involving marijuana use. Unique associations of race, cigarette smoking, trauma exposure, religious service attendance, depression, and conduct problems with initiation patterns were observed. Compared with the typical sequence, frequency of alcohol use was lower for all other patterns (odds ratios [ORs] = 0.28–0.50), but frequency of marijuana use was lower exclusively for “marijuana only” (OR = 0.42). **Conclusions:** These findings underscore the need for prevention programs to consider heterogeneity in patterns of initiating alcohol and marijuana use and correlates of patterns among both Black and White adolescents. They also indicate that initiation sequence is a stronger predictor of frequency of use for alcohol than for marijuana. (*J. Stud. Alcohol Drugs*, 80, 120–128, 2019)

THE LOWER PREVALENCE OF ALCOHOL USE in Black relative to White adolescents has long been documented (Jackson et al., 2002; Malone et al., 2012), with the reverse trend of modestly higher prevalence of marijuana use in Black youth documented for recent birth cohorts (Johnston et al., 2018), suggesting possible variations across race in pathways to alcohol and marijuana use. The current study was designed to gain a more nuanced understanding of these variations through an in-depth exploration of the sequence of alcohol use relative to marijuana use initiation in Black and White female youth. Specifically, we characterized patterns of alcohol and marijuana use initiation with respect to known correlates of adolescent substance use, proportion of Black versus White girls, and frequency of alcohol and marijuana use at age 17.

Sequence of initiation of alcohol relative to marijuana use

The typical sequence of initiation is licit substances—that is, alcohol and nicotine—before illicit substances (Degenhardt et al., 2009; Kandel & Faust, 1975; Wells & McGee,

2008), often referred to as the “gateway sequence” (although we use the term *typical*, as it does not imply causality). However, deviations from this sequence have been observed across studies, with Black youth and adults more likely than their White counterparts to follow atypical sequences (i.e., illicit before licit substances; Guerra et al., 2000; Sartor et al., 2013). For example, in Guerra et al.’s study of 8,550 high school students, Black students were 3 times as likely as White students to initiate use of illicit drugs before alcohol or cigarettes and 2.3 times as likely to start using them in the same year. Similarly, in earlier work by our group using a large ($n = 4,102$) population-based sample of young women, among participants who used both alcohol and marijuana, 37% of Black women, compared with only 13% of White women, used marijuana first (Sartor et al., 2013).

Although potentially informative for developing targeted interventions, distinctions between typical and atypical initiation patterns by socioenvironmental, psychosocial, or psychiatric factors have rarely been investigated. Greater access to illicit drugs in disadvantaged neighborhoods, where Black families are disproportionately represented (Peterson & Krivo, 2005), has been posited as a factor in Black youth more commonly trying marijuana before alcohol (Guerra et al., 2000; White et al., 2007), but we are aware of only one prior study to address this hypothesis. In a sample of 192 young adult males (18.8% Black), Tarter and colleagues (2006) found a link between poor physical environment and atypical sequence of initiation. Prior efforts to identify associations of psychiatric risk factors with atypical initia-

Received: August 9, 2018. Revision: November 19, 2018.

Funding for this study was provided by the National Institute on Alcohol Abuse and Alcoholism (Grant No. AA023549), the National Institute on Drug Abuse (Grant No. DA012237), the National Institute on Mental Health (Grant No. MH056630), FISA Foundation, and Falk Foundation.

*Correspondence may be sent to Carolyn E. Sartor at the Department of Psychiatry, Yale University School of Medicine, 389 Whitney Avenue, New Haven, CT, 06511, or via email at: carolyn.sartor@yale.edu.

tion patterns are also limited, the only known study being an examination of internalizing and externalizing disorders as predictors of “gateway” compared to “reverse gateway” sequence in adult National Comorbidity Survey participants (Degenhardt et al., 2009). Many of the well-documented risk and protective factors for early substance use, including trauma (Carliner et al., 2016; Dube et al., 2006), religious involvement (Wallace et al., 2003), and parental monitoring (Ryan et al., 2010) have yet to be investigated in relation to the sequence of licit relative to illicit substance use initiation.

Association of alcohol and marijuana use initiation patterns with problem use

Beyond contributing to etiological models of substance use, the identification of variations in patterns of alcohol and marijuana use initiation may be informative for determining whether sequence of alcohol relative to marijuana use initiation (or use of only one of the two substances) is indicative of liability to risky use. However, the link between initiation patterns and alcohol- or marijuana-related problems has rarely been investigated and findings are mixed. Drawing data from 254 sons of fathers with a substance use disorder, Tarter and colleagues (2012) found that initiating use of marijuana before alcohol and/or tobacco was not significantly associated with likelihood of developing cannabis use disorder by age 22. By contrast, in our prior study of young women, using marijuana before alcohol was associated with a rapid transition from first use to onset of cannabis use disorder symptoms (Sartor et al., 2013). We are unaware of any studies to date to examine patterns of initiation of alcohol relative to marijuana use as predictors of earlier markers of problem use, notably, alcohol and marijuana use during adolescence.

Aims of the current study

The first aim of the current study was to identify distinctions by race in alcohol and marijuana use initiation patterns from ages 11 to 17 in Black and White girls in the context of a wide range of well-documented socioenvironmental, psychosocial, and psychiatric correlates of substance use. We made use of an all-female sample, given the higher prevalence of certain risk factors, such as childhood sexual abuse (Pereda et al., 2009), and potential greater impact of protective factors, such as parental monitoring (Sanchez, 2010; Svensson, 2003), on substance use outcomes in girls, suggestive of gender-specific risk pathways. We opted to focus on alcohol and marijuana only rather than follow some prior studies in (1) collapsing alcohol and nicotine into a single category of “licit drug,” given differences in associations of alcohol and nicotine with certain risk factors (e.g., socioeconomic status; Bonevski et al., 2014), or (2) categorizing based on all three substances, which would result in such a large number of initiation patterns that meaningful

interpretations would not be possible. Many of the factors considered, including socioeconomic status (Macartney et al., 2013), neighborhood conditions (Peterson & Krivo, 2005), trauma exposure (Gibson et al., 2009; Wildeman et al., 2014), and religious involvement (Meyers et al., 2017), have been found to vary by race and thus may inform our interpretation of racial differences.

The second aim was to assess whether sequence of initiation would predict frequency of alcohol and marijuana use at age 17 across race, after considering factors that predicted initiation patterns. These aims are driven in part by our broader goal of testing assumptions regarding the generalizability of findings from the existing literature on adolescent substance use (based in large part on predominantly White samples) to Black youth. Thus, consistent with prior studies (Guerra et al., 2000; Sartor et al., 2013), we treated the typical sequence of alcohol before marijuana use initiation, which is more common among White than Black youth (Guerra et al., 2000; Moss et al., 2014; Sartor et al., 2013), as the reference group.

In addition to anticipating a lower prevalence of the typical sequence in Black compared with White girls, we hypothesized that girls who used alcohol before marijuana would report the highest frequency of alcohol use. Parallel findings for marijuana, i.e., that girls who used marijuana before alcohol would report the highest frequency of marijuana use, were also expected. We further hypothesized that the prevalence of risk factors (e.g., psychiatric conditions) would be lower and the prevalence of protective factors (e.g., religious involvement) would be higher among abstainers than among those who used both substances—as well as for alcohol-only and marijuana-only users, given that use of multiple substances is most prevalent among high-risk youth.

Method

Participants

The Pittsburgh Girls Study (PGS; $N = 2,450$) is a longitudinal study of an urban community sample, oversampled for low-income neighborhoods, of four female age cohorts (ages 5–8 at Wave 1). The protocol was approved by the University of Pittsburgh’s Human Research Protection Office. Participants were recruited in 1999–2000, with 85.2% of eligible families completing the first wave of data collection. Girls and their primary caregivers completed assessments annually. PGS sample retention was high: 88.5% on average over the years that data used in the current analyses were collected (2003–2010), when girls were 11–17 years old. Detailed descriptions of sample ascertainment can be found in prior publications (Hipwell et al., 2002; Keenan et al., 2010). As our interest was in differences between Black and White girls, we excluded the small subsample ($n = 144$) identified as other race. An additional 140 cases that were missing

TABLE 1. Measurement of socioeconomic status, neighborhood factors, protective factors, and risk factors

Construct	Measure(s)	Reporter	Alpha (across waves)
Socioeconomic status indicators and neighborhood factors			
Primary caregiver education level	Interview question	Primary caregiver	—
Household receipt of public assistance	Interview question	Primary caregiver	—
Single parent household status	Interview question	Primary caregiver	—
Low neighborhood safety	Your Neighborhood (Loeber et al., 1998)	Primary caregiver	.95–.96
Community cohesion	Community Survey (Gorman-Smith et al., 2000)	Primary caregiver	.91–.92
Neighborhood physical disorder	6 items from Interviewer Impressions of the Neighborhood (Wei et al., 2005)	Interviewer	.69–.73
Protective factors			
Religious service attendance	Interview question: “In the past year, how often did you attend religious services?”	Child	—
Parental monitoring	4 items from Supervision and Involvement Scale (Loeber et al., 1998)	Child	.61–.74
Risk factors			
Early puberty	1 item from Pubertal Development Scale (Petersen et al., 1988)	Child	—
Trauma exposure	Child PTSD Symptom Scale (Foa et al., 2001); Conflict Tactics Scale–Romantic Partner (Straus et al., 1996); Child Police Contact, Health Questionnaire (Loeber et al., 1998); Abuse Questionnaire, Victimization Under the Influence of Alcohol or Drugs (developed by the Pittsburgh Girls Study)	Primary caregiver & child	—
Cigarette smoking	Nicotine, Alcohol, and Drug Substance Use measure (Pandina et al., 1984)	Child	—
Conduct problems	Adolescent Symptom Inventory–fourth edition (Gadow & Sprafkin, 1997)	Child	.64–.75
Depression	Adolescent Symptom Inventory–fourth edition (Gadow & Sprafkin, 1997)	Child	.74–.84
Anxiety	Screen for Child Anxiety and Related Disorders (Birmaher et al., 1997)	Child	.90–.92

either alcohol data or marijuana data in all waves were also excluded, resulting in a final analytic sample of 2,166 (56.9% Black, 43.1% White). A larger proportion of White than Black participants were excluded (7.4% vs. 5.0%), $\chi^2(1) = 5.84$, $p < .05$, reflecting the overall attrition pattern.

Procedure

Written informed consent from the primary caregiver and verbal assent from the child were obtained. Trained research staff conducted face-to-face interviews in participants' homes, separately for the girl and her primary caregiver (94% mothers). The protocol for maintaining confidentiality was explained to all participants. Families were compensated for study participation.

Assessment

Alcohol use was assessed starting at age 11 via the Nicotine, Alcohol, and Drug Substance Use self-report measure (NADU; Pandina et al., 1984), which queries frequency and usual quantity of alcohol consumption over the past year. There are eight response options for frequency, ranging from

I didn't within the past year, to every day or more than once a day. Because of low endorsement of *every day or more than once a day* and *nearly every day*, they were combined with *two or more times per week*. Age at initiation was calculated as the age at which respondents first reported any past-year alcohol consumption.

Marijuana use was also assessed starting at age 11 with the NADU, using the same response options for frequency as used for alcohol. Age at initiation of marijuana use was coded as the age at which any use was first reported.

Socioeconomic status, neighborhood factors, protective factors, and risk factors were measured and operationalized as described in Table 1. Additional details on operationalization of childhood trauma can be found in a prior publication (Sartor et al., 2018).

Analytic approach

Analyses were conducted in SAS (Version 9.4; SAS Institute, Inc., Cary, NC). Participants were categorized based on sequence of first alcohol and marijuana use into 1 of 6 possible patterns: (1) alcohol before marijuana (typical sequence), (2) alcohol and marijuana at the same age,

(3) marijuana first, (4) marijuana only, (5) alcohol only, and (6) neither. Analyses of variance and chi-square tests of association were conducted to assess for differences across initiation patterns in socioenvironmental, psychosocial, and psychiatric factors and proportion of Black versus White girls. To capture risk and protective factors present at the time of first substance use, with the exception of cigarette smoking and trauma exposure, they were coded using status at the age when the first substance was used. (For example, for a participant who tried alcohol at age 14 and marijuana at age 15, the conduct problems variable was coded as the value at age 14.) Given the potential long-term or delayed impact of exposure to trauma and cigarette smoking on risk for initiation of alcohol and marijuana use, these variables were coded positive for any exposure before or at the age when the first substance was used. Abstainers were coded according to status at age 17.

To address our first aim, we began by conducting a series of multinomial logistic regression analyses predicting patterns of initiation by the following domains: (1) race, (2) socioeconomic and neighborhood factors, (3) protective factors (i.e., religious service attendance and parental monitoring), and (4) risk factors (i.e., early puberty, trauma, cigarette smoking, and psychiatric conditions). To create the most parsimonious model, we included only significant variables from domain-specific models in the final model. Typical sequence was the reference group. (Results of the multinomial logistic regression analysis using “neither” as the reference group are reported in Supplemental Table A. Supplemental material appears as an online-only addendum to the article on the journal’s website.)

To address our second aim, we conducted separate ordinal logistic regression analyses for frequency of alcohol use and frequency of marijuana use. Dummy variables were used to represent patterns of initiation as predictors, with typical sequence as the reference group. Interactions between race and dummy variables were included to test for race differences in frequency of use as a function of initiation pattern. Models were adjusted for the significant covariates from the multinomial logistic regression analysis. Frequency of alcohol use and marijuana use by sequence of initiation are reported in Supplemental Table B.

Results

Prevalence and correlates of alcohol and marijuana use initiation patterns

The prevalence of each pattern of initiation is reported by race in Table 2. Among both Black and White girls who used alcohol and marijuana, alcohol before marijuana was the most common sequence. However, whereas less than 3% of White girls used either only marijuana or marijuana before alcohol, nearly 14% of Black girls followed one of those pat-

terns. Age at initiation of alcohol and marijuana use differed significantly by initiation pattern, with the alcohol first group being the earliest initiators of alcohol use and the marijuana first group being the earliest initiators of marijuana use. Results of analyses of variance and chi-square tests of the associations, shown in Table 2, revealed (omnibus) group differences for all risk and protective factors (p values below Bonferroni-adjusted p value of .003 for all analyses).

Model of patterns of alcohol and marijuana use initiation

Results of the final multinomial logistic regression analysis testing for associations of socioeconomic status, neighborhood factors, protective factors, risk factors, and race with initiation patterns are reported in Table 3. The odds of following an atypical pattern of initiation involving marijuana use were significantly greater for Black than White girls (odds ratios [ORs] = 2.45–8.38). History of cigarette smoking was associated with elevated risk for all patterns involving use of both alcohol and marijuana (ORs = 2.41–3.20). Trauma exposure was associated with elevated odds of all atypical patterns (ORs = 1.54–1.97) other than same age at initiation. Depression was associated with modest reduction in odds of following any atypical pattern (ORs = 0.86–0.95). Conduct problems were associated with reduced odds of using alcohol only and abstaining from both substances (ORs = 0.82, 0.54, respectively) and modestly elevated odds of initiating alcohol and marijuana at the same age (OR = 1.13). Higher frequency of religious service attendance was associated with reduced likelihood of abstaining from both substances, initiating at the same age, and using only marijuana (ORs = 0.70–0.76).

Frequency of alcohol and marijuana use at age 17 as a function of initiation pattern

Results of ordinal logistic regression analyses using patterns of initiation to predict frequency of alcohol and marijuana use at age 17 are shown in Table 4. Race by pattern of initiation interactions were nonsignificant in both alcohol and marijuana models. Both models were adjusted for significant covariates identified in the multinomial logistic regression analysis: frequency of religious service attendance, trauma exposure, cigarette smoking, conduct problems, and depression.

In the alcohol model, compared with the typical sequence, all other initiation patterns were associated with significantly lower frequency of consumption (OR = 0.28, 95% CI [0.22, 0.37] for alcohol only, OR = 0.50, 95% CI [0.35, 0.71] for same age and OR = 0.45, 95% CI [0.28, 0.73] for marijuana before alcohol). An independent effect for race was also observed; frequency of consumption was lower for Black girls than White girls. In the marijuana model, only one initiation pattern differed in frequency of use from

TABLE 2. Patterns of alcohol and marijuana use initiation in Black and White girls: Associations with socioeconomic status, neighborhood factors, protective factors, and risk factors,^a and age at first use

Variable	Alcohol first (n = 391)	Same age (n = 218)	Marijuana first (n = 84)	Marijuana only (n = 113)	Alcohol only (n = 591)	Neither (n = 769)
Race ^b						
Black	15.6%	12.2%	6.0%	7.9%	19.1%	39.2%
White	21.3%	7.3%	1.1%	1.6%	38.1%	30.6%
Socioeconomic status indicators						
Primary caregiver education <12 years ^c	14.3%	19.1%	17.9%	24.5%	9.7%	13.6%
Receipt of public assistance ^c	34.0%	48.6%	56.0%	57.1%	27.4%	41.7%
Single-parent-headed household ^c	43.0%	56.3%	66.7%	66.7%	34.8%	52.7%
Neighborhood factors						
Low safety, <i>M (SD)</i>	22.58 (7.49)	23.83 (8.28)	24.77 (8.77)	24.79 (9.31)	22.06 (7.13)	22.30 (7.47)
Cohesion, <i>M (SD)</i>	33.80 (8.90)	31.88 (9.54)	30.23 (7.48)	29.92 (9.20)	34.98 (8.84)	32.02 (9.21)
Physical disorder, <i>M (SD)</i>	0.90 (1.27)	1.07 (1.27)	1.67 (1.38)	1.08 (1.44)	0.75 (1.10)	0.99 (1.20)
Frequency attended religious services ^c						
Never	17.1%	28.0%	22.6%	28.3%	18.0%	24.9%
Occasionally	40.2%	35.8%	34.5%	39.6%	36.0%	38.9%
Weekly	26.7%	25.7%	22.6%	21.7%	31.6%	25.5%
>Weekly	16.0%	10.5%	20.2%	10.4%	14.4%	10.7%
Parental monitoring, <i>M (SD)</i> ^d	4.98 (1.29)	5.44 (1.56)	5.45 (1.43)	5.26 (1.53)	4.72 (1.15)	4.77 (1.35)
Early puberty (menses by age 11) ^c	28.4%	36.2%	35.7%	30.1%	23.4%	32.0%
Experienced 1+ traumatic events ^c	12.8%	21.6%	25.0%	25.7%	14.0%	14.7%
Smoked cigarettes ^c	18.9%	45.0%	33.3%	27.4%	11.0%	5.1%
Conduct problems, <i>M (SD)</i>	2.05 (2.25)	3.35 (2.96)	2.70 (2.49)	1.83 (2.15)	1.09 (1.59)	0.47 (1.20)
Depression, <i>M (SD)</i>	9.65 (4.96)	9.13 (5.09)	8.32 (5.02)	7.91 (5.61)	7.48 (4.59)	5.20 (4.43)
Anxiety, <i>M (SD)</i>	15.87 (9.71)	14.77 (9.38)	12.99 (7.90)	13.98 (10.12)	14.77 (9.00)	12.72 (9.52)
Age at first alcohol use, <i>M (SD)</i>	12.66 (1.43)	14.81 (1.57)	15.74 (1.27)	—	14.11 (2.08)	—
Age at first marijuana use, <i>M (SD)</i>	15.30 (1.37)	14.81 (1.57)	13.94 (1.38)	15.90 (1.32)	—	—

Notes: ^aLifetime status by age first substance used (at age 17 for never users) for cigarette smoking and trauma exposure, status at age first substance used for all other factors; ^bdistribution within race; ^cprevalence/distribution within class; ^dper standard scoring procedures, higher values reflect lower monitoring; all group comparisons statistically significant at $p < .002$ (below Bonferroni-adjusted p value of .003).

the typical sequence: girls who never used alcohol used marijuana less frequently (OR = 0.42, 95% CI [0.27, 0.66]). Race was not independently associated with frequency of marijuana use.

Discussion

Our investigation revealed that differences between Black and White adolescent girls in patterns of alcohol and marijuana use initiation are evident even after considering a wide range of socioenvironmental, psychosocial, and psychiatric correlates of substance use. Furthermore, it revealed psychosocial and psychiatric factors that contribute to variations in initiation patterns independent of race. Of note, three are known to vary in prevalence across racial groups: cigarette smoking (Garrett et al., 2013), trauma exposure (Gibson et al., 2009; Wildeman et al., 2014), and religious involvement (Meyers et al., 2017). In addition, we uncovered distinctions by pattern of initiation in frequency of alcohol and marijuana use in Black and White adolescent girls.

Race differences in endorsement and variations in age at first use by pattern of initiation

Across racial groups, among girls who used at least one of the two substances (60.8% of Black girls, 69.4% of White

girls) between ages 11 and 17, the most common pattern of initiation was alcohol only. Consistent with prior studies that included Black and White participants (Guerra et al., 2000; Sartor et al., 2013; White et al., 2007), among girls who used both substances, the most common sequence of initiation was alcohol before marijuana use. Also in keeping with prior work on race differences in patterns of initiation, Black girls were overrepresented in all atypical initiation patterns involving marijuana use (Guerra et al., 2000; Sartor et al., 2013; White et al., 2007), including marijuana only (Moss et al., 2014), whereas White girls were twice as likely as Black girls to report using only alcohol. Our findings with respect to age at first use are also closely aligned with prior studies in this area (Richmond-Rakerd et al., 2015; Sartor et al., 2013). The earliest age at initiation of alcohol use was reported by girls who used alcohol before marijuana; likewise, girls who used marijuana before alcohol reported the earliest age at first marijuana use.

Associations of socioenvironmental, psychosocial, and psychiatric factors with initiation patterns

In an effort to identify sources of variations in initiation patterns and gain insight into differences across race, we focused on risk and protective factors known to vary in prevalence between Black and White youth, including so-

TABLE 3. Results of multinomial logistic regression predicting pattern of alcohol and marijuana use initiation in Black and White girls^a

Variable	Odds ratios [95% confidence intervals]				
	Same age	Marijuana first	Marijuana only	Alcohol only	Neither
Black (vs. White) race	2.45 [1.67, 3.59]	8.08 [3.98, 16.39]	8.38 [4.53, 15.50]	0.78 [0.59, 1.03]	2.91 [2.17, 3.91]
Frequency attended religious services	0.76 [0.63, 0.91]	0.91 [0.72, 1.17]	0.70 [0.55, 0.88]	1.00 [0.87, 1.15]	0.76 [0.66, 0.88]
Experienced 1+ traumatic events	1.52 [0.95, 2.42]	1.91 [1.05, 3.46]	1.97 [1.13, 3.42]	1.54 [1.03, 2.28]	1.66 [1.10, 2.52]
Smoked cigarettes	3.20 [2.14, 4.79]	2.55 [1.46, 4.48]	2.41 [1.41, 4.10]	0.69 [0.47, 1.01]	0.48 [0.30, 0.76]
Conduct problems	1.13 [1.05, 1.21]	1.04 [0.94, 1.15]	0.89 [0.80, 1.00]	0.82 [0.76, 0.89]	0.54 [0.48, 0.60]
Depression	0.95 [0.92, 0.98]	0.93 [0.88, 0.98]	0.94 [0.89, 0.98]	0.94 [0.92, 0.97]	0.86 [0.84, 0.89]

Notes: **Bold** indicates $p < .05$. ^aReference group = alcohol first.

cioeconomic status (Macartney et al., 2013), neighborhood factors (Peterson & Krivo, 2005), trauma exposure (Gibson et al., 2009; Wildeman et al., 2014), religious involvement (Meyers et al., 2017), and cigarette smoking (Garrett et al., 2013). High frequency of attendance at religious services was associated with reduced likelihood of following certain patterns of initiation: using only marijuana, initiating alcohol and marijuana use at the same age, and most notably, abstaining from both alcohol and marijuana use. Religious involvement may therefore be understood as protecting against deviation from the typical initiation pattern. Our findings related to trauma exposure suggest the reverse direction of effect: experiencing one or more traumatic events was associated with increased likelihood of following any of the atypical patterns of initiation, other than alcohol and marijuana use initiation at the same age, but including abstention from both substances.

The results from our univariate analyses of neighborhood variables were consistent with those from the one known study to examine neighborhood factors in relation to patterns of substance use initiation (Tarter et al., 2006). Participants endorsing atypical patterns involving marijuana use had higher scores on neighborhood physical disorder and low neighborhood safety, and lower scores on community cohesion, than those following the typical sequence. However, in our multivariate models, which included race, these associations were nonsignificant, suggesting that distinctions observed in the univariate analyses reflected race differences in neighborhood factors. Similarly, all three indicators of low socioeconomic status were higher in the three groups endorsing atypical patterns involving marijuana use in univariate analyses but nonsignificant in multivariate models. In the only known prior study to examine socioeconomic status in relation to patterns of initiation, Guerra et al. (2000) found that, in White but not Black adolescents, low maternal education predicted initiation of illicit substances at the same or earlier age than licit substances. Distinctions from their

findings are likely attributable to our inclusion of additional indicators of socioeconomic status as well as neighborhood factors, which share sources of variance.

Consistent with evidence that conduct disorder is a global risk factor for substance use outcomes (Krueger et al., 2002), conduct problems were associated with lower likelihood of abstaining from both alcohol and marijuana use and of using only alcohol. By contrast, depression was associated with lower odds of following any of the atypical patterns of initiation. In the only prior investigation to examine psychiatric disorders in relation to initiation patterns (Degenhardt et al., 2009), associations were nonsignificant. However, inconsistencies with our findings are not entirely unexpected, given the older age of their sample and their operationalization of internalizing and externalizing problems as counts of disorders in each category rather than individual diagnoses. The prevalence of lifetime (any) cigarette smoking in our study was higher among girls who followed any of the atypical patterns involving both alcohol and marijuana use or abstained from both substances. (Additional information on cigarette smoking is reported in Supplemental Table C.) This is consistent with studies reporting elevation in risk attributable to the common route of administration for marijuana and tobacco (Agrawal & Lynskey, 2009) and more broadly with the high rates of co-occurrence of cigarette smoking with alcohol and marijuana use (Falk et al., 2006).

Patterns of initiation and frequency of use

We hypothesized that frequency of alcohol use at age 17 would be higher in girls who used alcohol before marijuana. In the absence of prior studies on associations between initiation patterns and adolescent use, our hypothesis was based on two premises. The first was that use of multiple substances is a marker of risk for problem use and thus, girls using both would be at greater risk for heavy use than those using only one substance. The second was that among

TABLE 4. Results of ordinal logistic regression analyses predicting frequency of alcohol and marijuana use at age 17 as a function of pattern of initiation^a

Variable	Odds ratios [95% confidence intervals]	
	Alcohol use	Marijuana use
Black (vs. White) race	0.44 [0.35, 0.56]	1.25 [0.93, 1.69]
Sequence of initiation		
Alcohol only	0.28 [0.22, 0.37]	—
Marijuana only	—	0.42 [0.27, 0.66]
Same age	0.50 [0.35, 0.71]	0.89 [0.64, 1.24]
Marijuana first	0.45 [0.28, 0.73]	0.98 [0.61, 1.55]
Age at first use	1.12 [1.05, 1.18]	1.03 [0.93, 1.13]
Frequency attended religious services	0.96 [0.86, 1.08]	0.95 [0.83, 1.09]
Experienced 1+ traumatic events	0.75 [0.55, 1.01]	0.76 [0.54, 1.08]
Smoked cigarettes	0.99 [0.74, 1.31]	1.26 [0.93, 1.71]
Depression	1.01 [0.99, 1.03]	1.00 [0.97, 1.02]
Conduct problems	1.00 [0.95, 1.06]	1.07 [1.01, 1.14]

Notes: **Bold** indicates $p < .05$. ^aReference group = alcohol first.

girls who used both, using alcohol first might reflect preference for and/or relative ease of access to alcohol, resulting in more frequent use. We found support for this hypothesis; all atypical patterns of initiation were associated with lower frequency of alcohol use than the typical pattern. However, we did not find support for the parallel hypothesis for marijuana—that is, that frequency of marijuana use would be higher for girls using marijuana before alcohol than those following the typical sequence. The marijuana only initiation pattern was associated with lower frequency of use, but neither the same age nor the marijuana first sequence differed significantly from the typical sequence. This suggests that it is the use of both substances, rather than the sequence of initiation, that predicts higher frequency of marijuana use. Of note, the absence of significant interactions by race indicates that these relationships hold for both Black and White adolescent girls.

Limitations

Several limitations of this study should be noted. First, inferences regarding prevalence and correlates of initiation patterns and their associations with frequency of use are limited to alcohol and marijuana use during adolescence. Second, we operationalized initiation as any level of use, as our focus was on exposure to alcohol and marijuana and the scale used for reporting quantity of marijuana use did not capture the range in the current sample well. Variations in patterns of development of regular or heavy use and their associations with the socioenvironmental, psychosocial, and psychiatric factors considered here may differ. Third, the sample was recruited from an urban area, with oversampling of low-income neighborhoods, so findings may not generalize to Black and White girls in nonurban or higher income populations. Last, our analyses were focused on characterizing variations in the sequence of alcohol relative to marijuana use initiation and their associations with frequency

of use in late adolescence, and thus by no means provide a comprehensive model of substance use initiation during adolescence.

Conclusions and future directions

Results of the current study provide further evidence for variation in patterns of initiation of alcohol and marijuana use, including differences by race, and provide some insight into sources of this variation among Black and White adolescent girls. The absence of independent contributions of socioeconomic status and neighborhood factors to initiation patterns when examined jointly with race suggests that the higher proportion of Black compared with White youth initiating marijuana use before, in the absence of, or at the same age as alcohol use is not attributable to influences related to socioeconomic disadvantage, e.g., higher exposure to drug dealing in the neighborhood. Identification of the sources of differences across race—which may include variations in norms, attitudes, or motives for use of each substance—is a key next step in this line of research. Our finding that the typical sequence of initiating alcohol before marijuana use is associated with the highest frequency of alcohol use runs counter to the idea that atypical patterns are markers of risk for heavy use. The relatively limited association of initiation patterns with frequency of marijuana use suggests that the sequence relative to alcohol use (or absence of alcohol use) is not a strong predictor of adolescent marijuana use. Future studies of other racial/ethnic groups are needed to guide more focused prevention efforts in young females, but our findings demonstrate that prevention programs need to take into account heterogeneity in patterns of alcohol and marijuana use initiation.

Acknowledgments

The authors thank all of the research participants and their families for the time they dedicated to this study.

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