

Cannabis or alcohol first? Differences by ethnicity and in risk for rapid progression to cannabis-related problems in women

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Background. Initiation of cannabis use typically follows alcohol use, but the reverse order does occur and is more common for African-Americans (AAs) than European-Americans (EAs). The aim of this study was to test for differences in the order of initiation of cannabis and alcohol use between AA and EA women and to determine whether order and ethnicity contribute independently to risk for rapid progression to cannabis-related problems.

Method. Data were drawn from structured psychiatric interviews of 4102 women (mean age = 21.6 years), 3787 from an all-female twin study and 315 from a high-risk family study; 18.1% self-identified as AA, 81.9% as EA. Ethnicity and order of initiation of cannabis and alcohol use were modeled as predictors of transition time from first use to onset of cannabis use disorder symptom(s) using Cox proportional hazards regression analyses.

Results. AA women were nearly three times as likely as EA women to initiate cannabis use before alcohol use. Using cannabis before alcohol [hazard ratio (HR) 1.44, 95% confidence interval (CI) 1.08–1.93] and AA ethnicity (HR 1.59, 95% CI 1.13–2.24) were both associated with rapid progression from first use to cannabis symptom onset even after accounting for age at initiation and psychiatric risk factors.

Conclusions. The findings indicate that AA women are at greater risk for rapid development of cannabis-related problems than EA women and that this risk is even higher when cannabis use is initiated before alcohol use. Prevention programs should be tailored to the various patterns of cannabis use and relative contributions of risk factors to the development of cannabis-related problems in different ethnic groups.

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Introduction

An estimated 40–50% of young adults have used cannabis (Coffey *et al.* 2002; Degenhardt *et al.* 2008; Johnston *et al.* 2008). Lifetime diagnostic criteria for cannabis abuse or dependence are met by 10–20% of adult cannabis users (Anthony *et al.* 1994; Stinson *et al.* 2006; Teesson *et al.* 2006; Copeland & Swift, 2009) and more than a third of adolescent users report experiencing at least one dependence symptom (Nocon *et al.* 2006). Cannabis users, particularly early initiators, are at elevated risk for negative psychosocial outcomes such as dropping out of high school and being fired from jobs, in addition to substance-related outcomes

such as use of other illicit drugs, nicotine dependence and alcohol use disorders (AUDs) (Brook *et al.* 1999; Lynskey & Hall, 2000; Brook *et al.* 2002; Ellickson *et al.* 2004; Lessem *et al.* 2006). Although rates of cannabis use and dependence are higher in males (Wallace *et al.* 1999; Stinson *et al.* 2006; Wagner & Anthony, 2007), the gender gap is closing (Degenhardt *et al.* 2008; Schepis *et al.* 2011). Recent evidence also shows that girls transition more rapidly from experimentation to regular use (Schepis *et al.* 2011) and experience a greater decrease in quality of life as a consequence of cannabis use than boys (Lev-Ran *et al.* 2012), indicating a clear need for further research on problem cannabis use in girls and women.

The pathway from initiation of use to onset of cannabis-related problems is part of a more general developmental course of substance use. First use of both alcohol and cannabis typically occurs in mid-adolescence (Vega *et al.* 2002; Newes-Adeyi *et al.* 2004).

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The order of onset has been the subject of much discussion since the introduction of the gateway hypothesis by Kandel & Faust (1975), who argued that initiating use of alcohol and cigarettes before cannabis and cannabis before other illicit drugs is nearly universal among those who ever use illicit drugs. A follow-up at age 35 years of the original adolescent sample further supported their theory (Kandel *et al.* 1992), as did several large-scale population-based studies (Degenhardt *et al.* 2008; Wells & McGee, 2008). For example, Behrendt *et al.* (2012) reported that 93% of lifetime (ever) alcohol and cannabis users in a community-based sample tried alcohol first. Deviations from the gateway sequence are more common in high-risk populations, suggesting a possible link between sequence of initiation and substance-related outcomes. Tarter *et al.*'s (2006) study of sons of alcoholics revealed that 22% who had ever used cannabis tried it before alcohol, and in a study of methadone patients by Mackesy-Amity *et al.* (1997), nearly 40% reported initiating cannabis before alcohol use.

Deviations from the gateway sequence are also more common in African-Americans (AAs) than in European-Americans (EAs). Initiation of cannabis use before first drink or first cigarette was reported by 10.5% of AAs *versus* less than 1% of EAs in an inner-city sample (White *et al.* 2007). Similarly, in Guerra *et al.*'s (2000) report based on a survey of more than 85000 high-school students, when compared to EAs, AAs were three times as likely to initiate use of illicit drugs before alcohol or cigarettes and 2.3 times as likely to start using them in the same year. Studies examining potential differences by ethnicity in rates of lifetime cannabis use have produced mixed results (Wallace *et al.* 1999; White *et al.* 2007; Shih *et al.* 2010; Chen & Jacobson, 2012) and the evidence suggests that risk for progression to dependence in AAs is equal to or lower than risk for EAs (Chen *et al.* 2005; Stinson *et al.* 2006). However, recent studies have shown that AAs mature out of cannabis use later than members of other ethnic groups (Chen & Jacobson, 2012; Finlay *et al.* 2012) and, according to data from two large-scale nationally representative samples, the prevalence of cannabis abuse and dependence is growing faster among AAs than all other ethnic groups (Compton *et al.* 2004). The question of whether these trends are associated with the higher frequency of initiating cannabis before alcohol use among AAs has yet to be addressed, but such an investigation could uncover a pathway of risk to which AAs are particularly vulnerable. The few known studies to address order of initiation in relation to problem cannabis use have focused specifically on dependence. In Tarter *et al.*'s (2006) sample of 224 male offspring

of alcoholics, dependence risk was no higher for those who used cannabis before alcohol than for those who followed the reverse sequence. Similarly, in Degenhardt *et al.*'s (2009) analysis of data from the National Comorbidity Survey Replication (NCS-R), use of cannabis before alcohol and tobacco was not associated with development of dependence. It is not yet known whether this relationship holds when using less stringent criteria for defining problem use.

In the current study we extended the existing literature on the relationship between the order of initiation of cannabis *versus* alcohol use and the development of problem cannabis use in several ways. First, we made use of a large all-female sample in which AAs were well represented, allowing us to test for differences between AAs and EAs and to examine the potential contributions to cannabis-related problems of risk factors more commonly experienced by girls, such as childhood sexual abuse (CSA) (Fergusson *et al.* 1996; Walker *et al.* 2004). Second, we examined a novel phenotype, the rate of progression from first use to onset of first cannabis use disorder (CUD) symptom, which captures the developmental course of problem cannabis use better than a lifetime dependence diagnosis. Third, we conducted a parallel analysis of progression from first drink to first AUD symptom to assess whether the pattern observed for cannabis is distinct from that of alcohol. The overall aim of the study was to determine whether order of initiation and ethnicity are independent contributors to risk for rapid progression to CUD symptoms after accounting for psychiatric risk factors associated with problem cannabis use.

Method

Participants

The sample was composed of 3787 female twins who completed the fourth wave of data collection for the Missouri Adolescent Female Twin Study (MOAFTS) and a subset of participants (females in the same age range as MOAFTS participants, $n=315$) who completed the baseline interview for the Missouri Family Study (MOFAM), a high-risk family study that oversampled for AAs.

MOAFTS

Twins born in Missouri to Missouri-resident parents between 1975 and 1985 were identified through birth records and recruited between 1995 and 1999 for the baseline (wave 1) assessment. Cohorts of 13-, 15-, 17- and 19-year-old female twin pairs and their families were ascertained in the first 2 years; new cohorts of 13-year-old twins and their families were added in the

subsequent 2 years. Parent interviews were completed by 78% of eligible families (see Heath *et al.* 2002 for details on ascertainment). Wave 3 retest interviews were conducted with a subset of wave 1 participants 2 years after the wave 1 assessments. (Data were not drawn from wave 2, which referenced experiences from only the previous 24 months.) Wave 4 assessments were conducted from 2002 to 2005. Of the 4638 twins identified from birth records, 80% completed the wave 4 interview ($n=3787$). The mean age at wave 4 was 21.7 (s.d.=2.8, range=18–29) years; 14.6% of participants self-identified as AA, the remainder as EA.

MOFAM

From 2003 to 2009, Missouri state birth records were used to identify families with at least two adolescent children, one aged 13, 15, 17 or 19 years at the time and at least one other aged ≥ 13 years. Biological mothers completed brief telephone screening interviews that included questions assessing excessive drinking in the father. Families of fathers with a history of excessive drinking were classified as high risk and were invited to enroll. The remaining (low-risk) families were invited to enroll until the target number of low-risk families was reached. A second group of high-risk families was identified through driving records. Men with two or more drunk-driving citations were matched to birth record data to identify prospective families. In all participating families, mothers were interviewed first. Permission was then sought from mothers to recruit offspring and biological fathers were solicited for interview. Mothers, fathers and offspring were each interviewed by different raters, who were blind to family risk status. The method of family ascertainment is described in detail in a previous publication (Calvert *et al.* 2010). In total, 317 families of non-AA (primarily EA) descent and 450 AA families were enrolled in the study. For the current study, data were drawn from the 315 female participants aged ≥ 18 (mean=20.7, s.d.=2.8, range=18–31) years to match age and gender of the MOAFTS sample; 60.3% self-identified as AA, the remainder as EA.

The combined sample thus comprises 4102 women, 18.1% of AA descent, 81.9% of EA descent, with a mean age of 21.6 (s.d.=2.8, range=18–31) years.

Procedure and assessment battery for MOAFTS and MOFAM

By design, MOFAM assessments were almost identical to MOAFTS assessments to facilitate integration of data across studies. In both studies, data were collected by trained interviewers through an

interview modified for telephone administration from the Semi-Structured Assessment for the Genetics of Alcoholism (Bucholz *et al.* 1994; Hesselbrock *et al.* 1999), an instrument designed to assess DSM-IV substance use and other psychiatric disorders in addition to related psychosocial domains. The MOFAM interview and each of the three MOAFTS interviews queried lifetime history and diagnostic information. Verbal consent was obtained prior to the start of the interview. Both studies were approved by the Washington University Human Research Protections Office. MOFAM was also approved by the Ethics Board of the State Department of Health and Senior Services (not required at the time that MOAFTS was begun).

Outcomes and covariates

In MOAFTS, data from waves 1 and 3 were available for 78% of participants. In cases where onset of use or symptoms was reported in more than one wave of data collection, the first report was used. Cannabis abuse but not dependence symptoms were assessed in waves 1 and 3, so all cannabis dependence symptom reports were from wave 4. In MOFAM, age onset information was available only for cannabis dependence symptoms.

Outcomes

Cannabis. Individuals who endorsed one or more DSM-IV diagnostic criteria for either cannabis abuse or cannabis dependence were considered positive for CUD symptom(s). Age at first symptom onset was derived from reported age(s) that each endorsed symptom was first experienced.

Alcohol. To be considered positive for AUD symptom(s), participants needed to endorse at least one DSM-IV alcohol abuse symptom or one alcohol dependence symptom other than tolerance. Cases with tolerance only, which comprised 30% of AUD symptom cases, were dropped to create a more conservative definition of problem alcohol use, in keeping with evidence of inflated rates of tolerance endorsement in young drinkers suggestive of misinterpretation of tolerance questions (Chung & Martin, 2005; Caetano & Babor, 2006; Harford *et al.* 2009). Age at symptom onset was derived from reported age(s) that each endorsed symptom was first experienced.

Covariates

A range of psychiatric and psychosocial factors associated with problem cannabis and alcohol use were included as covariates in analyses: maternal and paternal alcohol problems, childhood physical abuse

or neglect (CPAN), childhood sexual abuse (CSA), major depressive disorder (MDD), conduct disorder (CD), and regular smoking. Interview items used to derive status on each of these covariates are provided in Table A1 in the online Appendix.

Data analysis

Age at first use, order of initiation, transition to first symptom, and ethnicity

Participants were categorized into one of six groups based on reported age at first cannabis and/or alcohol use: (1) cannabis before alcohol, (2) both at same age, (3) alcohol before cannabis, (4) cannabis only, (5) alcohol only, or (6) never used either. Mean ages at first use of cannabis and alcohol were calculated by category and ethnicity. Analyses of variance were conducted to test for age differences by category, *t* tests for differences by ethnicity. Timing of transition from first use to first symptom was calculated using reported ages of initiation and symptom onset and divided into three categories: (1) same age, (2) 1–2 years, or (3) ≥ 3 years.

Predicting rate of progression from first use to first symptom by order of initiation and ethnicity

Cox proportional hazards regression analyses were conducted to predict CUD symptom onset and AUD symptom onset, using age at first use as the origin. This analytic approach was chosen because not all participants had passed through the age of risk for onset of problem use of alcohol or cannabis. Order of initiation was modeled using three dummy variables representing group 1 (cannabis before alcohol), group 2 (same age), plus 4 (cannabis only) for the cannabis model, and 5 (alcohol only) for the alcohol model. Group 3 served as the reference group because alcohol before cannabis was the most common order for users of both substances. Ethnicity, maternal and paternal alcohol-related problems and CD were entered into the models as time-invariant variables. Regular smoking, MDD, CPAN and CSA were modeled as time-varying covariates by creating a ‘person-year’ data set using SAS (SAS Institute, 2008). In cases that were positive for a given covariate, the corresponding variable was coded as absent in each year prior to age of onset and present for each subsequent year. Analyses were adjusted for age at first use and age at time of symptom report using dummy variables representing the lowest and highest thirds of the distributions. For age at first use, dummy variables represented ≤ 15 and ≥ 18 for cannabis, ≤ 14 and ≥ 18 for alcohol; for symptom report, ≤ 19 and ≥ 24 for cannabis, ≤ 18 and ≥ 23 for alcohol. Adjustments

were made for sampling design by including dummy variables representing each of the three risk groups in MOFAM. Analyses were conducted in Stata version 8.2 (StataCorp, 2007) using the Huber–White correction to adjust for the non-independence of observations in siblings.

Base models, which included only ethnicity, order of initiation, maternal and paternal alcohol problems, age at first use, age at time of symptom report, sampling design, and alcohol (cannabis model)/cannabis use (alcohol model), were run prior to running models including psychiatric covariates.

The proportional hazards assumption that risk remains constant over time was tested using the Grambsch and Therneau test of the Schoenfeld residuals (Grambsch & Therneau, 1994). Violations were observed for the variables representing: initiation of cannabis and alcohol use at the same age (all four models); alcohol use, cannabis before alcohol use, ethnicity, paternal alcohol-related problems, and age at first cannabis use (cannabis base and covariate models); age at first drink and age at AUD symptom report (alcohol base and covariate models); regular smoking (cannabis and alcohol covariate models); and age at CUD symptom report (cannabis base model). To adjust for the violations, the period of risk was split into ≤ 8 , 12, 16, 20 and ≥ 24 years, and variables representing interactions between variables with violations and subdivisions of the period of risk were entered into the models. (Detailed information on combinations of interactions included in each model is available upon request.)

Results

Order of initiation, age at first use, transition to first symptom, and ethnicity

Rates of both lifetime cannabis and alcohol use differed significantly across ethnicity, with AA women more likely than EA women to use cannabis [49.7% *v.* 44.4%, $\chi^2_{(1)} = 6.89$, $p = 0.009$] and EA women more likely than AA women to consume alcohol [88.1% *v.* 78.7%, $\chi^2_{(1)} = 45.14$, $p < 0.0001$]. Mean age at first use of cannabis did not differ by ethnicity (16.6 *v.* 16.4 years for AAs and EAs respectively, $t_{532} = 1.22$, $p = 0.22$) but mean age at first drink was a full year younger for EAs than for AAs (15.8 *v.* 16.9 years, $t_{747} = 8.10$, $p < 0.0001$). The distribution across the six categories of cannabis and alcohol use also differed significantly by ethnicity [$\chi^2_{(5)} = 238.3$, $p < 0.0001$], as shown in Table 1. Among women who used both substances, AAs were nearly three times as likely as EAs to use cannabis before alcohol (37% *v.* 13%). AA women were 10 times as likely as EA women to

Table 1. Prevalence (%) and order of initiation of alcohol and cannabis use for African-Americans (AAs) and European-Americans (EAs)

Ethnicity	Used alcohol and cannabis					
	Cannabis first	Same age	Alcohol first	Cannabis only	Alcohol only	Neither
AA (<i>n</i> =742)	17.4	11.0	18.1	3.2	32.4	17.9
EA (<i>n</i> =3348)	5.8	9.5	28.7	0.3	44.0	11.7

$$\chi^2_{(6)} = 238.3, p < 0.0001.$$

use only cannabis. The number of AAs using cannabis before alcohol was nearly equal to the number using alcohol before cannabis, whereas EA women were five times as likely to use alcohol before cannabis than the reverse. As shown in Table 2, the youngest age at first use of cannabis was reported by individuals who used cannabis before alcohol. For alcohol, the youngest age was reported by those who used alcohol before cannabis (14.7 years) and was almost identical to the age at first cannabis use in the cannabis before alcohol group (14.8 years). Rates of CUD symptoms were significantly higher in AA than EA cannabis users [27.9% *v.* 21.9%, $\chi^2_{(1)} = 6.10, p = 0.01$] whereas rates of AUD symptoms were significantly higher in EA than AA drinkers [39.7% *v.* 30.1%, $\chi^2_{(1)} = 19.12, p < 0.0001$]. Distributions of transition times from first use to symptom onset are shown by ethnicity and order of initiation in Table A2 in the online Appendix.

Predicting rate of progression from first use to first symptom by order of initiation and ethnicity

The results of the Cox proportional hazards regression analyses predicting time from first cannabis use to first CUD symptom are reported in Table 3. The base model is shown along with the model including psychiatric covariates to illustrate the impact of these covariates on hazard ratio (HR) estimates. After adjusting for maternal and paternal alcohol-related problems, CPAN, CSA, MDD, CD, regular smoking and the influence of alcohol use, AA ethnicity was associated with an accelerated rate of progression to symptom onset [HR 1.59, 95% confidence interval (CI) 1.13–2.24]. An independent effect was observed for use of cannabis before alcohol as well; this pattern was also associated with rapid progression from first use to first symptom (HR 1.44, 95% CI 1.08–1.93). Interaction terms representing ethnicity by order of initiation were non-significant. As shown in Table 4, ethnicity and order of initiation also predicted AUD symptom onset but produced a different pattern of results. After adjusting for the same covariates used in the cannabis model, AA ethnicity was associated with a significantly slower transition from first drink to first AUD

symptom (HR 0.74, 95% CI 0.61–0.90) and use of alcohol before cannabis was associated with a rapid rate of progression to AUD symptom (all HRs for variables representing patterns of initiation were significantly lower than the reference group, alcohol before cannabis). Interactions between ethnicity and order of initiation variables were non-significant.

Discussion

In the current investigation, we tested for differences in the order of initiation of cannabis and alcohol use between AA and EA women to determine whether order and ethnicity contribute independently to risk for rapid progression to cannabis-related problems. The results reveal that AA women are more likely than EA women to use cannabis before alcohol and that, even after adjusting for ethnicity and psychiatric correlates of problem cannabis use, initiation of cannabis before alcohol use was associated with an elevated rate of progression to cannabis-related problems. Parallel analyses examining progression to problem drinking produced similar results, that is, women who used alcohol first progressed the most rapidly, indicating that this pattern of findings is not specific to cannabis.

Ethnicity

AA women in our sample were equally likely to try cannabis before alcohol as the reverse and, consistent with prior investigations (Guerra *et al.* 2000; White *et al.* 2007), were three times as likely as EA women to use cannabis before alcohol. Rates of CUD symptoms were also higher in AA than EA cannabis users (27.9% *v.* 21.9%), indicating a higher risk of CUD development given exposure (and not a reflection of the higher rates of use in AA participants). Differences between our study and earlier studies that reported the same or lower rates of CUDs in AAs *versus* EAs may be explained in part by the lower threshold for problem use in the current study; that is, a less severe syndrome of cannabis-related problems may be more commonly found in AAs. The elevated HR for AA ethnicity in the

Table 2. Mean age (years) at initiation of alcohol and cannabis use by ethnicity and order of initiation

Substance	Ethnicity		Order of initiation					
	AA	EA	Cannabis first	Same age	Alcohol first	Cannabis only	Alcohol only	
Cannabis	16.6 (2.5)	16.4 (2.3)	14.8 (2.1)	15.6 (1.7)	17.2 (2.2)	16.3 (2.4)	-	$F_{3,1848} = 143.0$ $p < 0.0001$
Alcohol	16.9 (2.9)	15.8 (2.4)	16.8 (2.2)	15.6 (1.8)	14.7 (2.1)	-	16.8 (2.5)	$F_{3,3580} = 200.0$ $p < 0.0001$

AA, African-American; EA, European-American.
 Values given as mean (standard deviation).

Cox proportional hazards regression analyses, also indicative of higher risk for cannabis-related problems in AA cannabis users, can be interpreted as an elevated rate of progression from initiation to CUD symptom, a phenotype that is distinct from the dichotomous indicator of meeting full CUD diagnostic criteria. The timing of transition phenotype provides different information about the development of problem substance use and analysis of this phenotype may even produce results that seem to contradict analyses based on a dichotomous indicator of substance use disorder (Stallings *et al.* 1999; Sartor *et al.* 2007). (For example, early initiates of alcohol use are at greater risk than later initiates for alcohol dependence but transition more slowly; Sartor *et al.* 2008.)

The authors of the two known studies documenting ethnic differences in the order of initiation of cannabis and alcohol use have suggested two possible explanations: greater access to cannabis and a higher degree of acceptability of cannabis use in the AA community (Guerra *et al.* 2000; White *et al.* 2007). However, neither study tested these hypotheses and the literature on availability of cannabis and attitudes toward use fails to support them. Compared with EA adolescents, AA adolescents report less access to cannabis, the same or even higher parental disapproval of cannabis use, and the same amount of peer substance use (Gillmore *et al.* 1990; Wallace *et al.* 1999). Given the limited literature in this area, we can only speculate on explanations for this trend. One possibility is simply that the ordering reflects the relatively late age at initiation of alcohol use among AAs, as reported in prior studies (Wagner *et al.* 2002; Rothman *et al.* 2009) as well as the current study. The elevated risk for rapid progression to CUD symptoms among AA *versus* EA women observed in our sample is likely attributable in part to the higher degree of exposure to a broad range of risk factors for CUDs, including domains such as family- and school-related influences not measured in the current study (Gil *et al.* 2002), but this issue has yet to be addressed in the literature.

Order of initiation

Use of cannabis before alcohol was associated with rapid progression to problem cannabis use even after accounting for psychiatric covariates, lower age at first use and over-representation of AAs among those reporting this order of initiation. The association between order of first use of cannabis *versus* alcohol and risk for cannabis-related problems has only rarely been studied and the few studies to address this issue found no difference in risk by order of initiation. Discrepancies in findings between our study, based on a large all-female sample drawn primarily from the

Table 3. Results of Cox proportional hazards regression analyses predicting transition time from initiation of cannabis use to onset of first cannabis use disorder (CUD) symptom^a

	Base model HR (95% CI)	Model with covariates HR (95% CI)
Alcohol use	2.73 (1.78–4.17)*	1.95 (1.27–2.99)*
Order of initiation ^b		
Cannabis first	1.41 (1.07–1.87)*	1.44 (1.08–1.93)*
Same age	0.91 (0.64–1.28)	0.89 (0.61–1.29)
No alcohol	1.43 (0.59–3.48)	1.26 (0.51–3.09)
AA ethnicity	1.27 (0.94–1.70)	1.59 (1.13–2.24)*
Maternal alcohol problems	1.52 (1.20–1.91)*	1.27 (0.99–1.63)
Paternal alcohol problems	1.19 (0.94–1.49)	1.01 (0.80–1.28)
Childhood physical abuse or neglect (CPAN)	–	1.09 (0.86–1.39)
Childhood sexual abuse (CSA)	–	1.40 (1.11–1.77)*
Major depressive disorder (MDD)	–	1.30 (1.03–1.65)*
Conduct disorder (CD)	–	1.82 (1.41–2.35)*
Regular smoking	–	2.04 (1.58–2.64)*

AA, African-American; HR, hazard ratio; CI, confidence interval.

^a Adjusted for age at time of symptom report, age at first use, sampling design, and proportional hazards violations.

^b Alcohol first as reference group.

* $p < 0.05$.

general population, and those from Tarter *et al.*'s (2006) study using 224 sons of alcoholics may be attributable to gender differences in patterns of use and/or greater power to detect differences in our sample. Comparisons to findings both from Tarter *et al.*'s (2006) study and from Degenhardt *et al.*'s (2009) study based on NCS-R data should be made with caution because, as noted earlier, we measured a phenotype that captures timing of transitions through stages of use and reflects a lower range of severity. Through examination of this novel phenotype, we identified a link between initiation of cannabis before alcohol use and a previously unexamined component of the course of problem cannabis use.

Comparison of cannabis versus alcohol use and symptom onset

Parallel analyses of alcohol use and AUD symptom onset produced very similar results to those observed for cannabis. First, higher prevalence of a substance within an ethnic group was associated with greater likelihood of using that substance first (cannabis for AAs, alcohol for EAs). Second, higher rates of symptoms were reported for the first than the second substance used. Third, the earliest age at first use was reported by individuals who used that substance first.

Fourth, just as use of cannabis before alcohol was associated with an elevated rate of progression to CUD symptom onset, use of alcohol before cannabis was associated with an elevated rate of progression to AUD symptom onset. Fifth, for both cannabis and alcohol, the groups with the lowest rates of symptoms were those that did not use the other substance, suggesting that the use of more than one substance is a marker of risk for problem use. Finally, with the exception of CSA (significant in the cannabis but not the alcohol model), the same psychiatric covariates were associated with liability to progression to symptom onset. In short, initiation of cannabis before alcohol use does not reflect a qualitatively different pathway of risk than the more typical sequence of alcohol before cannabis.

Limitations

The results should be interpreted with certain limitations in mind. First, we did not include peer substance use, which has consistently been linked to problem use of cannabis and alcohol (van den Bree & Pickworth, 2005; D'Amico & McCarthy, 2006; Korhonen *et al.* 2008; Wang *et al.* 2009), in our models. To model accurately the influence of peers on the transition from first use to AUD or CUD symptom, information on

Table 4. Results of Cox proportional hazards regression analyses predicting transition time from first drink to onset of first alcohol use disorder (AUD) symptom^a

	Base model HR (95% CI)	Model with covariates HR (95% CI)
Cannabis use	1.16 (0.96–1.40)	1.18 (1.00–1.38)
Order of initiation ^b		
Cannabis first	0.69 (0.57–0.84)*	0.68 (0.56–0.83)*
Same age	0.79 (0.68–0.92)*	0.78 (0.66–0.91)*
No cannabis	0.40 (0.34–0.47)*	0.45 (0.39–0.53)*
AA ethnicity	0.72 (0.60–0.86)*	0.74 (0.61–0.90)*
Maternal alcohol problems	1.17 (1.00–1.36)	1.03 (0.88–1.21)
Paternal alcohol problems	1.23 (1.09–1.39)*	1.09 (0.97–1.24)
Childhood physical abuse or neglect (CPAN)	–	1.09 (0.95–1.25)
Childhood sexual abuse (CSA)	–	1.14 (0.97–1.33)
Major depressive disorder (MDD)	–	1.38 (1.22–1.55)*
Conduct disorder (CD)	–	1.47 (1.19–1.82)*
Regular smoking	–	1.22 (1.04–1.44)*

AA, African-American; HR, hazard ratio; CI, confidence interval.

^a Adjusted for age at time of symptom report, age at first use, sampling design, and proportional hazards violations.

^b Alcohol first as reference group.

* $p < 0.05$.

peer substance use specific to the age at which participants developed symptoms (rather than use by current peers) would be needed and such detailed data were not collected. However, by including risk factors in the models that are correlated with peer use, that is CD (Burt *et al.* 2009; Brook *et al.* 2011), parental alcohol problems (Hoffmann & Su, 1998; Haller *et al.* 2010) and age at first use (Coffey *et al.* 2000; Ellickson *et al.* 2004), we captured some of the variance in outcomes associated with peer substance use. Second, although minimized by the short lag time from first use and/or symptom onset to time of interview and the inclusion of age at onset data from the first interview in which use (or symptom) was reported, the potential bias introduced by retrospective reporting should be considered, particularly if it varies by ethnicity or substance. Third, some evidence suggests that AAs are more likely than EAs to recant reports of cannabis use (Fendrich & Johnson, 2005) and that AAs (but not EAs) who recant are less deviant than consistent reporters (Ensminger *et al.* 2007). The potential impact of such a reporting pattern in our data was reduced by using first rather than most recent reports of substance use, but there is a possibility that under-reporting of cannabis use was more common in AA than EA women in our sample, thus lowering the magnitude of ethnic differences. Fourth, the AA women in our sample were primarily from urban areas, where access to

cannabis and attitudes toward use may differ from rural or suburban areas.

Future directions and implications for prevention efforts

The extent to which order of initiation of cannabis and alcohol use differs by ethnicity and the implications of the sequence for progression to cannabis-related problems merits further investigation, including testing for differences across a broader range of ethnic groups and also by gender. The findings from the present study suggest that the development of cannabis-related problems does not follow a single pathway and that prevention efforts based on the gateway hypothesis that alcohol use precedes cannabis use may be less effective in AAs. Tailoring interventions to specific cultural groups to address the varying substance use patterns and influences of risk factors on cannabis use is crucial to reducing the incidence of the many negative psychosocial outcomes associated with problem use.

Supplementary material

For supplementary material accompanying this paper visit <http://dx.doi.org/10.1017/S0033291712001493>.

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Declaration of Interest

None.

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