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## Is cannabis use associated with an increased risk of onset and persistence of alcohol use disorders? A three-year prospective study among adults in the United States

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### Abstract

**Background**—The relationship between cannabis use and alcohol use disorders (AUDs) over time remains unclear. The current study used longitudinal data from adults in the United States (U.S.) to investigate the association between cannabis use and risk of onset and persistence of AUDs three years later.

**Methods**—The study used data from respondents who completed both waves of the National Epidemiological Study of Alcohol Use and Related Disorders (NESARC; Wave 1, 2001–2001; Wave 2, 2004–2005) and for whom the age of first cannabis use preceded the age of any AUD. Incident AUDs were examined among respondents with no lifetime AUD diagnosis at Wave 1 (n=27,461). Persistent AUDs were examined among respondents with a lifetime AUD diagnosis at Wave 1 (n=2,121).

**Results**—Among adults with no history of AUD, cannabis use at Wave 1 was associated with increased incidence of an AUD three years later relative to no cannabis use (Odds Ratio

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#### Contributors

Dr. Goodwin conceived the study and wrote sections of the manuscript. Dr. Weinberger helped to design the study, managed the literature searches, and wrote the first draft of the manuscript. Mr. Platt undertook the statistical analyses. All authors contributed to and approved the final manuscript.

#### Conflicts of Interest

Dr. Weinberger, Mr. Platt, and Dr. Goodwin have no conflicts of interest to report.

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(OR)=5.43; 95% Confidence Interval (CI)=4.54–6.49). Among adults with a history of AUD, cannabis use at Wave 1 was associated with increased likelihood of AUD persistence three years later relative to no cannabis use (OR=1.74; 95% CI=1.56–1.95). These relationships remained significant after controlling for demographics, psychiatric disorders, and other substance use disorders.

**Conclusions**—Cannabis use is associated with increased risk of AUD onset and persistence over the course of three years among U.S. adults. Community-based and clinical programs aimed at preventing or treating problematic alcohol use may benefit from integrating information about cannabis use in order to improve outcomes.

### Keywords

alcohol use disorders; cannabis; epidemiology; comorbidity

## 1. INTRODUCTION

Alcohol use-related disease and accidents are one of the leading causes of death in the U.S. (CDC, 2004; Stahre et al., 2014). For adults, there is a significant association between alcohol and cannabis use (e.g., Butterworth et al., 2014; Hyggen and Hammer, 2014) and use of alcohol and cannabis, compared to alcohol alone, is associated with heavier alcohol consumption and greater negative alcohol-related consequences (e.g., Hyggen and Hammer, 2014; Midanik et al., 2007; Subbaraman and Kerr, 2015). Less is known about the association between cannabis use and alcohol use disorders (AUDs). In a study using Wave 1 data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), cannabis dependence was significantly associated with a reduced likelihood of remission from alcohol dependence in univariate analyses (HR=0.55, 95% CI=0.32, 0.94), but this relationship was no longer significant in multivariate analyses (HR=0.64, 95% CI=0.37–1.13; Lopez-Quintero et al., 2011). It is not yet clear how cannabis use may be related to the onset and persistence of AUDs over time. Given the relationship of cannabis use to alcohol-related problems, it is important to gain a better understanding these potential relationships.

The current study used longitudinal data from a representative sample of U.S. adults to examine the association between cannabis use and the risk of onset and persistence of AUDs. It was expected that cannabis use among adults with no history of AUDs would be associated with greater risk of onset of AUDs three years later. It was also expected that cannabis use among adults with AUDs would be associated with greater risk of persistence of AUDs three years later. Further, the study explored whether the relationships between cannabis use and AUDs would persist after adjusting for demographics, psychiatric disorders, nicotine dependence, and other illicit drug use disorders

## 2. METHODS

### 2.1. Data Source and Study Population

The study used two waves of data from the National Epidemiological Study of Alcohol Use and Related Disorders (NESARC; Wave 1, 2001–2001, n=43,093; Wave 2, 2004–2005,

n=34,653) which surveyed a population representative sample of civilian, non-institutionalized, adults in the U.S. The study used a two-wave multistage stratified design in which primary sampling units, housing units, and group-quarter units were stratified to oversample certain under-represented socio-demographic groups, specifically, non-Hispanic Black, Hispanic, and young (ages 18–24) adults. The final data were weighted according to the demographic distribution of the U.S. population based on the 2000 census. Details regarding study design and administration have been described elsewhere (Grant et al., 2003; Grant and Kaplan, 2005).

## 2.2. Material and Methods

**2.2.1. Alcohol use disorders**—AUD diagnoses were determined using the NIAAA Alcohol Use Disorder and Associated Disabilities Interview Schedule–Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) Version (AUDADIS-IV), a fully structured diagnostic interview instrument (Grant et al., 2001) with good to excellent reliability and validity (Grant et al., 1995). To preserve statistical power and be as consistent as possible with the criteria for substance use disorders in the DSM-5 (APA, 2013), participants who received diagnoses of either alcohol abuse or alcohol dependence were classified as having an AUD.

**2.2.2. Cannabis use and use disorder**—Diagnosis of a cannabis use disorder was based on meeting criteria for items covering the DSM-IV criteria (APA, 1994). Cannabis use disorder was defined in the DSM-IV as increased tolerance, compulsive use, impaired control, and continued use despite physical and psychological problems caused or exacerbated by use during the year prior to the Wave 1 interview. Cannabis use was defined as any use of cannabis in the year prior to Wave 1 that did not meet criteria for a cannabis use disorder.

**2.2.3. Socio-demographic covariates and other potential confounders**—Following previously established rationale (Miettinen and Cook, 1981), socio-demographic covariates included gender, age, level of education, race/ethnicity groups (Asian/Pacific Islander, non-Hispanic Black, Hispanic, Native American/Alaskan, and non-Hispanic White), marital status (married/living with someone as married, widowed, divorced/separated, single), and income. Gender, race/ethnicity, and marital status were discrete variables while age, education, and income were continuous variables.

A summary dichotomous variable was created to for the presence of lifetime psychiatric disorders as measured at Wave 1, including major depression, manic depression, dysthymia, hypomania, panic disorder with/without agoraphobia, agoraphobia, social and specific phobia, generalized anxiety disorder, posttraumatic stress disorder, attention deficit-hyperactivity disorder, antisocial personality disorder, borderline personality disorder, and schizotypal or narcissistic personality disorder. Also, a dichotomous variable was created to adjust for any co-morbid DSM-IV substance use disorder including nicotine, sedatives, tranquilizers, opioids, heroin, amphetamines, cocaine, hallucinogens, inhalants/solvents, and other drugs.

## 2.3. Statistical Analysis

**2.3.1. Analytic samples**—Our full analytic sample included respondents who completed both waves of data collection, responded to all questions regarding cannabis and alcohol, and for whom the age of first cannabis use preceded the age of any AUD ( $n=29,582$ ; 69% of the original Wave 1 sample). From this full analytic sample, two separate subsamples were created to address our study questions. To examine incident AUDs, the sample was restricted to respondents with no lifetime AUD diagnosis prior to the Wave 1 interview ( $n=27,461$ ; 93% of the full analytic sample). To examine persistent AUD, the sample was restricted to respondents with a lifetime AUD diagnosis at Wave 1 ( $n=2,121$ ; 7% of the full analytic sample).

**2.3.2. Sample frequencies**—The frequency of AUDs at Wave 2 was compared among those with and without Wave 1 cannabis use. Standard errors were computed using Taylor series linearization and frequency differences were tested using Rao Scott chi-squared tests to account for complex survey design. Due to the small number of participants who reported a Wave 1 cannabis use disorder ( $n=42$  for participants with no Wave 1 AUD diagnosis and  $n=199$  for participants with a Wave 1 AUD diagnosis), comparisons of Wave 2 AUD diagnoses by cannabis use disorder were not conducted.

**2.3.3. Regression modeling**—A series of logistic regression models were run to model the odds of Wave 1 cannabis use and Wave 2 AUD status. A crude model was run to determine the unadjusted odds ratio (OR) of an AUD by cannabis use status (labeled as OR1 in Table 2). Then, four additional models were run to control for potential confounders and covariates measured at Wave 1. The first adjusted model controlled for socio-demographic covariates (OR2). A second model adjusted for lifetime history of psychiatric disorders (OR3). The third model adjusted for lifetime nicotine dependence and other illicit drug use disorders (OR4), and the fourth model included all covariates from the three previous models (OR2 through OR4; labeled as OR5).

All tests were completed in STATA using weighted analysis (StataCorp, 2011) to account for residual differences between the sample and the population profile, according to the 2000 United States Population Census, as well as to account for nonresponse and sample attrition.

## 3. RESULTS

### 3.1. Socio-demographics (Table 1)

Among respondents with no lifetime AUD diagnosis at Wave 1 ( $n=27,461$ ), 27,301 respondents (99.3%) reported no cannabis use while 160 respondents (0.7%) reported cannabis use in the year prior to the Wave 1 assessment. Wave 1 past year cannabis use was significantly higher among respondents who were: men, age 18–44, Native American/Alaskan Native, never married, and those who had completed a high school education, compared with those who reported no cannabis use. There was no difference in cannabis use by income level. The prevalence of AUDs was highest among respondents who were men, age 18–29, Hispanic, never married, reported an income of less than 35,000, and completed high school.

Among respondents who reported a lifetime AUD diagnosis at Wave 1 (n=2,121), 1,705 respondents (78.4%) reported no cannabis use while 416 respondents (21.6%) reported cannabis use in the year prior to the Wave 1 assessment. Among those who reported a lifetime AUD diagnosis at Wave 1, Wave 1 past year cannabis use was significantly higher among respondents who were: men, age 18–29, Native American/Alaskan Native, never married, and those with less than a high school education and an income of \$0–19,999, compared with those who did not use cannabis. The prevalence of AUDs followed the same general pattern as seen in cannabis use among this sample.

### 3.2. Wave 2 AUDs by Wave 1 cannabis use (Table 2)

Among those with no lifetime AUD at Wave 1, 23.3% of Wave 1 cannabis users reported a Wave 2 AUD compared to 5.3% of Wave 1 cannabis non-users. As shown in Table 2, Wave 1 respondents with no history of AUD at Wave 1 who reported Wave 1 cannabis users were 5.43 times more likely to report incident AUD compared to Wave 1 non-cannabis users (95% CI: 4.54–6.49). Wave 2 incident AUD was robust to adjustment in each of the separate and combined models. In the fully-adjusted model (OR5), Wave 1 cannabis users had a 2.12 times greater odds of incident AUDs compared to Wave 1 non-users (95% CI: 1.70–2.64).

Among those with lifetime AUDs at Wave 1, 59.1% of cannabis users reported a Wave 1 AUD compared to 45.4% of Wave 1 cannabis non-users. As shown in Table 2, among respondents with a lifetime diagnosis of an AUD at Wave 1, the unadjusted odds of a persistent AUD at Wave 2 were 1.74 times higher among cannabis users at Wave 1, compared with non-users at Wave 1 (95% CI: 1.56–1.95). The odds ratios were robust to adjustment by demographic covariates, Wave 1 lifetime psychiatric disorders, and Wave 1 lifetime nicotine dependence and other illicit drug use disorders. Estimates did not appreciably change when the co-morbid substance use disorder covariate was dichotomized by injectable (e.g., heroin, cocaine) and non-injectable (e.g., sedatives, hallucinogens) substances (data not shown). The fully adjusted odds of persistent AUD were 1.32 times higher among Wave 1 cannabis users, compared with non-users (95% CI: 1.17–1.50).

## 4. DISCUSSION

The results from this study suggest a significant relationship between cannabis use and subsequent increased risk of AUDs for adults without a past AUD and risk of continued AUD for adults with an AUD. These relationships remain robust after controlling for demographics, psychiatric disorders, and other substance use disorders. From a public health standpoint, it may be important to conduct further research on the relationship between cannabis and AUDs as well as other problematic alcohol-related outcomes. From a clinical perspective, it may be useful for cannabis treatment programs to consider assessing and monitoring problematic alcohol use as well as integrating topics related to alcohol (e.g., reasons for use, methods to decrease or stop use) into their programs.

It is important to note limitations of this study. Use of alcohol, cannabis, and other drugs were self-reported and not biochemically confirmed which may have led to underreporting of substance use especially for illegal substances. Due to the small sample of participants who reported cannabis use, we were not able to reliably examine the associations between

either the frequency of cannabis use or a cannabis use disorder diagnosis with AUDs. Future studies with larger samples of cannabis users should examine the association of frequency of cannabis use and a diagnosis of a cannabis use disorder to incident and persistent AUDs. Variables in the NESARC study were assessed at two time points and there was no information available regarding the timing or context of changes in cannabis or alcohol use behavior (e.g., the timing or context of the start of an AUD). It would be useful for future studies to examine contexts related to changes in the use of alcohol and cannabis and how changes in the use of cannabis (increases, decreases, initiation, and cessation) impacts changes in the use of alcohol. Finally, the NESARC study excluded individuals who were institutionalized, incarcerated, under the age of 18, or lived outside of the United States and results may not generalize to these groups.

In sum, our results suggest that cannabis use, compared to no cannabis use, is associated with increased risk of incident AUD among those without any history of AUD and an increased likelihood of persistence of AUD over a three-year period. Additional attention to alcohol use, alcohol use disorders, and alcohol-related problems among adults who use cannabis may be warranted.

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## References

- APA. Diagnostic And Statistical Manual Of Mental Disorders. 4. American Psychiatric Association; Washington, DC: 1994. DSM-IV
- APA. Diagnostic And Statistical Manual Of Mental Disorders. 5. American Psychiatric Association; Washington, DC: 2013. DSM-5
- Butterworth P, Slade T, Degenhardt L. Factors associated with timing and onset of cannabis use and cannabis use disorder: results from the 2007 Australian National Survey of Mental Health and Well-Being. *Drug Alcohol Rev.* 2014; 33:555–564. [PubMed: 25186194]
- CDC. Alcohol-attributable deaths and years of potential life lost - United States, 2001. *MMWR.* 2004; 53:866–870. [PubMed: 15385917]
- Grant, BF.; Dawson, DA.; Hasin, DS. The Alcohol Use Disorders and Associated Disabilities Interview Schedule-Version for DSM-IV (AUDADIS-IV). National Institute on Alcohol Abuse and Alcoholism; Bethesda, MD: 2001.
- Grant BF, Harford TC, Dawson DA, Chou PS, Pickering RP. The Alcohol Use Disorder and Associated Disabilities Interview schedule (AUDADIS): reliability of alcohol and drug modules in a general population sample. *Drug Alcohol Depend.* 1995; 39:37–44. [PubMed: 7587973]
- Grant, BF.; Kaplan, KD. Source And Accuracy Statement: The Wave 2 National Epidemiologic Survey On Alcohol And Related Conditions (NESARC). National Institute On Alcohol Abuse and Alcoholism; Rockville, MD: 2005.
- Grant, BF.; Moore, TC.; Shepard, J.; Kaplan, K. Source And Accuracy Statement For Wave 1 Of The 2001–2002 National Epidemiologic Survey On Alcohol And Related Conditions (NESARC). National Institute On Alcohol Abuse And Alcoholism; Bethesda, MD: 2003.

- Hyggen C, Hammer T. From cannabis to problem drinking? Use and abuse from youth to adulthood. *Nordisk Alkohol Nark.* 2014; 31doi: 10.2478/nsad-2014-0034
- Lopez-Quintero C, Hasin DS, de Los Cobos JP, Pines A, Wang S, Grant BF, Blanco C. Probability and predictors of remission from life-time nicotine, alcohol, cannabis or cocaine dependence: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Addiction.* 2011; 106:657–669. [PubMed: 21077975]
- Midanik LT, Tam TW, Weisner C. Concurrent and simultaneous drug and alcohol use: results of the 2000 National Alcohol Survey. *Drug Alcohol Depend.* 2007; 90:72–80. [PubMed: 17446013]
- Miettinen OS, Cook EF. Confounding: essence and detection. *Am J Epidemiol.* 1981; 114:593–603. [PubMed: 7304589]
- Stahre M, Roeber J, Kanny D, Brewer RD, Zhang X. Contribution of excessive alcohol consumption to deaths and years of potential life lost in the United States. *Prev Chronic Dis.* 2014; 11:130293.
- StataCorp. *Stata Statistical Software: Release 12.* StataCorp LP; College Station, TX: 2011.
- Subbaraman MS, Kerr WC. Simultaneous versus concurrent use of alcohol and cannabis in the national alcohol survey. *Alcohol Clin Exp Res.* 2015; 39:872–879. [PubMed: 25872596]

**Highlights**

- Cannabis use was associated with increased incidence of alcohol use disorders.
- Cannabis use predicted persistence of alcohol use disorder three years later.
- Relationships remained significant controlling for demographics and comorbidities.
- Integrating assessment of cannabis use into alcohol treatment may be beneficial.



**Table 1**

Demographic frequencies for the full sample (n=29,582) and frequencies of Wave 1 cannabis use and Wave 2 alcohol use disorders among participants with and without an alcohol use disorder diagnosis at Wave 1 by demographics.

Demographic variable	Total (n; %)		No Wave 1 AUD (n=27,461) (n; %)				Wave 1 AUD <sup>a</sup> (n=2,121) (n; %)							
			Wave 1 PY cannabis use	p	Wave 2 alcohol use disorder	p	Wave 1 PY cannabis use	p	Wave 2 alcohol use disorder	p				
<i>Gender</i>														
Men	12050	46.00	87	0.96	<.0001	377	3.31	<.0001	283	23.27	<.0001	365	27.04	0.0023
Women	17532	54.00	73	0.50		243	1.54		133	17.94		172	24.36	
<i>Age</i>														
18–29	4075	15.31	42	1.31	<.0001	191	5.91	<.0001	216	34.61	<.0001	175	29.79	<.0001
30–44	8607	28.51	82	1.31		215	2.70		138	19.84		202	26.02	
45–64	9900	35.43	34	0.43		185	1.87		62	10.71		154	25.71	
65+	7000	20.75	2	0.02		29	0.34		0	.		6	3.87	
<i>Race/Ethnicity</i>														
NH White	16866	71.77	115	0.76	<.0001	315	2.18	<.0001	268	21.61	<.0001	332	25.87	0.0055
NH Black	5707	10.88	15	0.39		138	2.85		49	20.42		86	29.93	
NH Native American/AK Native	460	2.04	7	2.21		10	2.69		18	37.83		18	34.94	
NH Asian/Pacific Islander	886	4.28	4	0.25		12	1.43		5	18.26		7	27.80	
Hispanic	5663	11.03	19	0.57		145	2.97		76	18.89		94	22.90	
<i>Marital status</i>														
Current	16109	64.43	70	0.55	<.0001	254	1.61	<.0001	119	13.62	<.0001	210	22.72	<.0001
Widowed, separated, divorced	7988	19.04	44	0.90		137	2.19		75	19.53		127	29.74	
Never	5485	16.53	46	1.12		229	5.55		222	34.85		200	29.73	
<i>Personal income</i>														
\$0–19,999	13482	43.21	71	0.71	0.1275	289	2.40	0.0008	198	30.31	<.0001	235	33.06	<.0001
\$20–34,999	6928	23.28	38	0.78		139	2.46		108	21.48		138	26.18	
\$35–69,999	6664	23.69	34	0.62		148	2.27		87	15.70		123	21.20	
\$70,000+	2508	9.83	17	0.72		44	1.75		23	10.18		41	17.85	
<i>Education</i>														
Less than HS degree	5025	14.25	23	0.70	<.0001	111	2.35	<.0001	68	29.48	<.0001	91	37.92	<.0001
High school degree	14425	49.48	86	0.83		335	2.54		224	23.03		281	25.08	
More than HS	10132	36.27	51	0.54		174	2.01		124	16.73		165	23.93	

NH, non-Hispanic; AK, Alaska; HS, high school; PY, past year

<sup>a</sup>Met criteria for past-year alcohol abuse and/or alcohol dependence

**Table 2**

Wave 2 alcohol use disorder (AUD) diagnosis by Wave 1 past-year cannabis use for participants with no lifetime AUD diagnosis at Wave 1 (n=27,461; past year cannabis use n=160; no past year cannabis use n=27,301) and participants with a lifetime AUD diagnosis prior to Wave 1 (n=2,121; past year cannabis use n=416; no past year cannabis use n=1,705).

Wave 1 PY cannabis use	No lifetime AUD (n=27,461) Wave 2 AUD <sup>a</sup>		With lifetime AUD (n=2,121) Wave 2 AUD <sup>a</sup>	
	OR	95% CI	OR	95% CI
OR1				
No use	<i>ref</i>		<i>ref</i>	
Any use	5.43	4.54–6.49	1.74	1.56–1.95
OR2				
No use	<i>ref</i>		<i>ref</i>	
Any use	3.29	2.64–4.09	1.55	1.39–1.74
OR3				
No use	<i>ref</i>		<i>ref</i>	
Any use	4.08	3.37–4.93	1.58	1.40–1.77
OR4				
No use	<i>ref</i>		<i>ref</i>	
Any use	3.7	3.12–4.39	1.54	1.37–1.75
OR5				
No use	<i>ref</i>		<i>ref</i>	
Any use	2.12	1.70–2.64	1.32	1.17–1.50

OR1. Unadjusted estimates

OR2. Adjusted for demographic covariates

OR3. Adjusted for Wave 1 psychiatric disorders

OR4. Adjusted for Wave 1 nicotine dependence and other illicit drug use disorders

OR5. Adjusted for all covariates in models 2–4

Key: AUD, alcohol use disorder; CI, confidence interval; OR, odds ratio; PY, past year

<sup>a</sup>Met criteria for past-year alcohol abuse and/or alcohol dependence