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Is cannabis use associated with increased risk of initiation, persistence, and relapse to cigarette smoking?: Longitudinal data from a representative sample of U.S. adults

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Abstract

Objective: The current study prospectively investigated the relationship between cannabis use and smoking initiation, persistence, and relapse over a three year period among adults in the United States.

Methods: Analyses included respondents who completed Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (2001–2002; 2004–2005) and responded to questions about cannabis use and smoking status (n=34,621). Multivariable logistic regression models were used to calculate the odds of cigarette use at Wave 2 among Wave 1 daily smokers, non-daily smokers, former smokers, and non-smokers by Wave 1 cannabis use.

Results: In unadjusted analyses, Wave 1 cannabis use was associated with increased odds of Wave 2 daily and non-daily smoking for Wave 1 non-smokers (daily OR=2.90; 95% CI=2.10–4.00; nondaily OR=4.45; 95% CI=3.97–5.00) and Wave 2 relapse to daily and non-daily smoking for

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Contributors

Dr. Goodwin conceived of the study and contributed to the interpretation of the results and manuscript writing. Dr. Weinberger wrote the first draft of the manuscript. Mr. Platt conducted the statistical analysis. Dr. Copeland contributed to the interpretation of the results and manuscript writing. All authors contributed to and have approved the final manuscript.

Previous Presentations

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Potential conflicts of Interest

The authors report no financial or other relationship relevant to the subject of this article.

Wave 1 former smokers (daily OR=4.18, 95%CI=3.01–5.81; nondaily OR=5.24; 95%CI=3.74–7.34). Wave 1 cannabis use was associated with decreased odds of Wave 2 smoking cessation for Wave 1 daily cigarette smokers (OR=0.57; 95%CI=0.51–0.64). The associations remained significant for daily smoking initiation, daily smoking relapse, and smoking cessation after adjusting for demographics and psychiatric disorders. Associations remained significant for non-daily smoking initiation and non-daily smoking relapse after adjusting for these covariates as well as alcohol and substance use disorders.

Conclusion: Cannabis use is associated with increased initiation, persistence, and relapse to cigarette smoking. Additional attention to cannabis use in tobacco control efforts and in clinical settings aimed at reducing cigarette smoking and smoking-related negative consequences may be warranted.

Keywords

cannabis; nicotine; cigarettes; cessation; relapse; longitudinal; epidemiology

INTRODUCTION

Smoking is a leading cause of preventable disease and death in the United States (U.S.) and around the globe^{1, 2} and the risk of mortality from smoking-related illnesses has increased over time.^{2, 3} While smoking cessation reduces or eliminates the negative consequences of smoking, most smokers are unable to quit or maintain abstinence over the long term.^{2, 4} It is therefore important to understand associates of smoking especially potential barriers to successful abstinence.

Cannabis is the most frequently used illicit drug in the U.S. and tobacco and cannabis are often used together—both in the sense that the same person uses both substances and that they can be co-administered (i.e., blunts). The use of cannabis by cigarette smokers has increased dramatically over the past two decades^{5, 6} to the point where smokers are more than 10 times as likely as non-smokers to use cannabis daily. Persons who use cannabis are more likely to report current smoking⁷ and cigarette smokers who use cannabis, compared to smokers who do not use cannabis, report a greater number of cigarettes smoked per day^{8, 9} and more symptoms of nicotine dependence.^{8, 10, 11} The use of cannabis and cigarettes together is associated with a range of negative physical, psychological, and social variables and less success with cannabis abstinence (see ^{12, 13} for reviews).

Moving beyond the well-documented link between cannabis use and cigarette smoking, less is known about the relationship between cannabis use and transitions in cigarette smoking status over time (e.g., smoking initiation, cessation, and relapse). Data from one cross-sectional sample of U.S. adolescents found that lifetime cannabis use was associated with decreased likelihood of a successful quit attempt.¹⁴ In community samples in the U.S. and Australia, past-six month cannabis use by adolescents was associated with increased smoking initiation as young adults¹⁵ while past-month cannabis use among adults was associated with a greater likelihood of continued tobacco use 13 years later.¹⁶

Few studies have examined investigated the association between cannabis use and smoking transitions using prospective, longitudinal data that is applicable to the general population. Among 5,590 men from Switzerland, lifetime cannabis use among nonsmokers was associated with the onset of daily smoking 18 months later.¹⁷ In a sample of U.S. adults, past-year cannabis use was associated with prevalence and incidence of nicotine dependence three years later.¹⁸ While these studies provide initial evidence for an association between cannabis use and increased risk of smoking onset and nicotine dependence, little is known about the association between cannabis use and smoking cessation or relapse over time in the general adult population.

Developing a better understanding of the relationship between cannabis use and transitions in and out of cigarette use seems quite critical and timely as cigarette smoking remains the leading preventable cause of mortality and morbidity in the U.S. and there has been increased use of cannabis in general^{19, 20} and among smokers.^{5, 6} The primary aim of the current study was to estimate the relationship between cannabis use and transitions in cigarette smoking over a three-year period. Specifically, the study examined the following questions: (1) Is cannabis use by non-smokers associated with increased risk of daily and non-daily cigarette smoking onset three years later? (2) Is cannabis use by daily and non-daily smokers associated with decreased likelihood of quitting and/or decreased cigarette smoking three years later? (3) Is cannabis use by former smokers associated with increased likelihood of relapse to cigarette smoking three years later? (4) Do these relationships persist after adjusting for demographics, psychiatric disorders, nicotine dependence, and alcohol/substance use disorders?

METHODS

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. Details regarding study design and administration have been described elsewhere.^{21, 22} The original NESARC data sets were obtained from the National Institute on Alcohol Abuse and Alcoholism (NIAAA, <http://www.niaaa.nih.gov>) and researchers can currently request specific analyses of the data sets through the NIAAA. All analyses were completed in STATA²³ using weighted analysis to account for residual differences between the sample and the population profile according to the 2000 U.S. Population Census, as well as to account for nonresponse and sample attrition.

Measures

Smoking Status.—Cigarette smoking status at Wave 1 and Wave 2 was classified using CDC definitions.²⁴ At Wave 1, respondents were classified into one of four mutually exclusive smoking statuses. Wave 1 non-smokers were defined as respondents who reported

smoking <100 lifetime cigarettes. Wave 1 former smokers were defined as respondents who reported smoked 100 lifetime cigarettes and no smoking at the time of the Wave 1 assessment. Wave 1 daily and non-daily smokers were defined as respondents who reported smoking 100 lifetime cigarettes and reported smoking some (non-daily smoking) or all (daily smoking) days at the time of the Wave 1 assessment. At Wave 2, respondents were classified as being non-smokers (i.e., <100 lifetime cigarettes and no past-year smoking at Wave 2), former smokers (i.e., 100 lifetime cigarettes and no past-year smoking at Wave 2), daily smokers (i.e., 100 lifetime cigarettes and smoking 7 days per week at Wave 2), or non-daily smokers (i.e., 100 lifetime cigarettes and smoking <7 days per week at Wave 2).

Cannabis use.—Cannabis use was defined as any past year use of cannabis at Wave 1.

Socio-demographic, psychiatric disorder, and substance use disorder

covariates.—Socio-demographics included gender (male, female), age (a continuous variable), level of education (a continuous variable), 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 (a continuous variable).

Psychiatric and alcohol/substance use diagnoses were determined using the 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 instrument²⁵ with good to excellent reliability and validity.^{26, 27} A summary dichotomous variable was created to for the presence of lifetime psychiatric disorders (yes/no) as measured at Wave 1 including major depressive disorder, bipolar disorder, 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 (yes/no) was created to adjust for nicotine dependence, alcohol use disorders, and substance use disorders (i.e., sedatives, tranquilizers, opioids, heroin, amphetamines, cocaine, hallucinogens, inhalants/solvents, and other drugs).

Statistical Analysis

Analytic sample.—Our full analytic sample included respondents who completed both waves of data collection, responded to questions about cannabis use at Wave 1, and responded to question about smoking status at both Wave 1 and Wave 2 (n=34,621; 80.3% of the original Wave 1 sample). From this full analytic sample, four separate analytic subsamples were created based on Wave 1 smoking status as defined above: Wave 1 non-smokers, Wave 1 former smokers, Wave 1 non-daily smokers, and Wave 1 daily smokers.

Sample frequencies.—The frequency of smoking status 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 (3.5% for participants who were Wave 1 current daily smokers, 3.8% for Wave 1 current non-daily smokers, 0.9% for Wave 1 former smokers, and 0.9% for Wave 1 non-smokers), analyses of changes in smoking status by cannabis use disorder were not conducted.

Regression modeling.—A series of logistic regression models were run to model the odds of Wave 1 past-year cannabis use and Wave 2 smoking status for the four Wave 1 smoking status groups: Wave 1 non-smokers (Table 2), Wave 1 former smokers (Table 3), Wave 1 daily smokers (Table 4), and Wave 1 non-daily smokers (Table 5). For each of the four smoking groups, a crude model was run first to determine the unadjusted odds ratio (OR) of a smoking status by cannabis use status (labeled as OR1 in Tables 2–5). Then, three 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 OR2 covariates plus lifetime history of psychiatric disorders (OR3). The third model adjusted for OR3 covariates plus lifetime nicotine dependence, alcohol use disorders, and other substance use disorders (OR4).

RESULTS

Sample characteristics (Table 1)

See Table 1 for demographics of the full analytic sample and by Wave 1 smoking status.

Wave 1 past-year cannabis use and changes in smoking status from Wave 1 to Wave 2

Wave 2 smoking onset among Wave 1 non-smokers.—Among non-cigarette smokers at Wave 1, cannabis use was associated with increased odds of initiation of daily and non-daily cigarette use at Wave 2 (Table 2). Wave 1 non-smokers who reported Wave 1 past-year cannabis use, compared to those who did not report Wave 1 past-year cannabis use, were nearly four and a half times more likely to report non-daily smoking at Wave 2 and nearly three times more likely to report daily smoking at Wave 2. The increased odds of non-daily smoking onset remained significant after controlling for Wave 1 demographics, psychiatric disorders, nicotine dependence, and alcohol/substance use disorders. The increased odds of daily smoking onset remained significant after controlling for Wave 1 demographics and psychiatric disorders but did not maintain significance after additional controls for nicotine dependence and alcohol/substance use disorders.

Wave 2 smoking relapse among Wave 1 former smokers.—Among Wave 1 former smokers, those with Wave 1 past-year cannabis use, compared to Wave 1 former smokers who did not report Wave 1 past-year cannabis use, were more than 5 times more likely to report relapse to non-daily smoking and more than 4 times more likely to report relapse to daily smoking at Wave 2 than Wave 1 former smokers who did not report past-year cannabis use (Table 3). The odds of Wave 2 non-daily smoking remained significant after controlling for Wave 1 demographics, psychiatric disorders, nicotine dependence, and alcohol/substance use disorders. The odds of Wave 2 daily smoking remained significant after controlling for demographics but not after controlling for psychiatric disorders, nicotine dependence, or alcohol/substance use disorders.

Wave 2 smoking behavior among Wave 1 daily and non-daily smokers.—Wave 1 daily smokers who reported Wave 1 past-year cannabis use, compared to Wave 1 daily smokers who did not report Wave 1 past-year cannabis use, were less likely to report quitting smoking at Wave 2 and this finding remained significant after controlling for demographics and psychiatric disorders (Table 4). Wave 1 daily smokers who reported past-year cannabis use were more likely to report decreasing cigarette frequency to non-daily at Wave 2 compared to those who did not report past-year cannabis use although this finding was no longer significant after controlling for demographics and other covariates. Among Wave 1 non-daily smokers, there was no significant relationship between cannabis use and the odds of increasing to Wave 2 daily smoking or decreasing to Wave 2 non-smoking (Table 5).

DISCUSSION

To our knowledge, the current study is the first to prospectively examine the association between past-year cannabis use and a range of smoking transitions over a three year period among adults in the U.S. Cannabis use, compared to no use, was associated with increased odds of smoking onset and relapse, and decreased odds of quitting smoking and reducing cigarette use from daily to non-daily smoking.

Previous work had shown that cannabis use disorders were associated with an increased likelihood of smoking initiation,²⁸ current smoking,^{7, 29} smoking maintenance,³⁰ and smoking relapse.³⁰ Our study extends this work to suggest that cannabis use, even in the absence of a cannabis use disorder, is also associated with increased risk of smoking onset, relapse, and persistence. As cannabis use is much more common than cannabis use disorder, the potential impact of cannabis use on cigarette use in the general community may be greater than estimates based on studies of cannabis use disorder alone.

There were a number of relationships between cannabis use and smoking transitions that were no longer significant after controlling for alcohol/substance use disorders including initiation of daily smoking, relapse to daily smoking, and smoking abstinence. The use of alcohol and illicit substances is associated with a greater prevalence of smoking and lower quitting.³¹ The use of these other drugs; or alternatively, the use of more than one drug (e.g., cannabis plus alcohol); may account for a large enough amount of variance in smoking transitions that the remaining variance due to the use of cannabis alone is too small to remain significant. While this study examines cannabis and smoking, it is important to recognize that use of other substances by cannabis users may also have negative impacts on smoking behavior.

Recent data from representative samples of the U.S. population find that the prevalence of past-year cannabis use has increased significantly over the past decade^{19, 20} and the rate of cannabis use initiation is also increasing with nearly 7,000 new users per day in 2014.¹⁹ Simultaneously, the percentage of adolescents and adults who perceive risks related to cannabis use has decreased and the percentage of people who believe there are no risks related to using cannabis has increased.^{19, 32} It is conceivable that changes in the laws around cannabis use and views of cannabis as accessible and without major harms may

result in increased cannabis use which may then have a negative impact on the smoking transitions seen in this study.

A number of mechanisms have been proposed to explain the high rates of co-use of nicotine and cannabis^{33, 34} that may be applicable to the association of cannabis use and changes in smoking behaviors. There are overlaps in the neurobiological systems involved with nicotine and cannabis (see ^{12, 34}). Consequently, a number of cannabis users report using tobacco to extend and enhance the effects of cannabis³⁵ and persons receiving nicotine through a transdermal patch, compared to a placebo patch, reported increased effects from cannabis including a higher heart rate and self-rating of being “stimulated” and “high”³⁶ (although see also ³⁷). Further, the use of nicotine or cannabis may alleviate negative effects of the other substance such as withdrawal symptoms³⁸ or cognition.^{39, 40} Both cannabis and nicotine are typically used by the same route of administration (i.e., inhalation) and are often used simultaneously through blunts which increases the amount of THC inhaled.⁴¹ Simultaneous users of cannabis and nicotine who try to stop using nicotine may experience cue-induced cravings for nicotine when using cannabis. There are likely multiple other psychosocial, individual, environmental, and genetics factors that influence the co-use of nicotine and cannabis. Future research that can examine how these potential mechanisms relate specifically to initiation, relapse, and cessation of cigarette use among those using cannabis is needed.

Several clinical trials that examined the association between cannabis use and smoking outcomes for persons receiving treatment to quit smoking found mixed results. While two studies found that cannabis use was associated with less success at quitting,^{42, 43} three studies found no association between cannabis use and smoking abstinence rates.^{44–46} Our study used epidemiologic data and therefore our results are generalizable to smokers in the population, very few of whom use the types of intensive smoking cessation treatments examined in these studies. It may be fruitful for future smoking cessation studies to assess cannabis use in participants and examine outcomes by cannabis use status. It may also be useful for smoking cessation treatment and outreach programs, including quitlines, to consider monitoring cannabis use as well as integrating topics related to cannabis use (e.g., reasons for use, methods to decrease or stop use). Treatments targeting both smoking and cannabis use appear to be feasible and to be successful—at least in the short term—in reducing nicotine use.^{47–49}

One limitation of this study is that there was no biological confirmation of smoking or cannabis use. Both smoking and cannabis use may be underreported^{50, 51} and persons underreporting cannabis use are more likely to also underreport tobacco use compared to persons who accurately report cannabis use.⁵² Second, due to the small samples sizes, we were not able to examine daily cannabis use or cannabis use disorder and changes in smoking behavior. This research question would be useful to study in samples with higher prevalences of daily cannabis use and cannabis use disorders (e.g., clinical samples). Third, analyses were limited to variables collected at the Wave 1 and Wave 2 interviews. No information was available regarding the context of smoking behavior changes (e.g., relapse) or utilization of smoking treatments. Fourth, longitudinal studies with a greater number of years of data would allow the examination of the association of cannabis use to changes in

smoking behaviors over a longer period of time. Fifth, results would need to be replicated in persons not included in the NESARC sample such as persons living outside of the U.S. or persons under the age of 18 who make up a large number of smoking initiators.^{53, 54}

In sum, our results suggest that cannabis use is associated with increased risk of cigarette smoking onset, decreased likelihood of smoking cessation, and increased risk of relapse among former smokers, over a three year period. Additional attention to cannabis use in tobacco control efforts and in clinical settings aimed at reducing the prevalence of cigarette smoking and long-term smoking-related negative consequences may be warranted.

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Table 1.
Demographic characteristics associated with cigarette use at Wave 1 among adults 18 and older in the United States.

	Total		Wave 1 non-smokers ¹		Wave 1 former smokers ²		Wave 1 non- daily smokers ³		Wave 1 daily smokers ⁴		p-value
	n	%	n	%	n	%	n	%	n	%	
Total	34639		20077	56.2	6232	18.3	1419	4.1	6911	21.5	<0.0001
<i>Gender</i>											
Men	14554	47.2	7385	42.1	3015	51.5	763	58.0	3391	54.5	<0.0001
Women	20085	52.8	12692	57.9	3217	48.5	656	42.0	3520	45.5	
<i>Age</i>											
18 to 29 years old	4911	15.7	3294	18.2	174	3.1	335	27.4	1108	17.6	<0.0001
30 to 44 years old	10602	30.0	6909	33.3	953	15.9	557	38.2	2183	31.7	
45 to 64 years old	11951	36.3	6119	32.6	2643	44.7	414	27.7	2775	40.5	
65+ years old	7175	18.0	3755	15.9	2462	36.3	113	6.7	845	10.3	
<i>Race/ Ethnicity</i>											
NH White	20155	72.7	10488	67.5	4342	82.5	817	72.3	4508	78.2	<0.0001
NH Black	6583	10.8	4186	12.5	924	7.0	209	8.1	1264	9.7	
NH Native American/ Alaska Native	578	2.2	262	1.8	96	1.8	32	2.9	188	3.4	
NH Asian/ Pacific Islander	968	3.9	722	5.3	103	2.1	29	3.3	114	2.0	
Hispanic	6355	10.4	4419	12.9	767	6.5	332	13.4	837	6.7	
<i>Marital status</i>											
Currently married	18860	64.3	11092	64.5	3753	72.2	703	58.3	3312	58.1	<0.0001
Previously married	9146	18.8	4688	16.0	1968	21.7	339	17.3	2151	23.7	
Never married	6633	17.0	4297	19.5	511	6.1	377	24.3	1448	18.3	
<i>Total Annual Family Income</i>											
\$0 to \$19,999	15180	41.8	8823	41.6	2529	38.4	539	37.5	3289	45.9	<0.0001
\$20,000 to \$34,999	8085	23.0	4491	22.0	1495	23.4	346	24.0	1753	25.1	
\$35,000 to \$69,999	8177	24.6	4758	24.7	1567	26.4	371	26.1	1481	22.5	
\$70,000 and higher	3197	10.6	2005	11.7	641	11.8	163	12.3	388	6.4	

Education	Total		Wave 1 non-smokers ¹		Wave 1 former smokers ²		Wave 1 non- daily smokers ³		Wave 1 daily smokers ⁴		p-value
	n	%	n	%	n	%	n	%	n	%	
Less than HS	5510	13.5	2970	11.4	998	14.4	177	10.5	1365	18.7	<0.0001
High school degree	16848	49.1	9145	45.4	3039	49.0	704	50.4	3960	58.6	
More than HS	12281	37.4	7962	43.2	2195	36.6	538	39.1	1586	22.8	
Lifetime psychiatric disorder ⁵	9714	27.8	4844	23.4	1722	27.9	494	34.3	2654	38.1	<0.0001
Lifetime substance use disorder ⁶	612	2.0	156	0.9	48	0.9	71	5.0	337	5.1	<0.0001
Nicotine dependence	5695	18.1	-	-	1106	18.7	415	30.7	4003	59.4	<0.0001
Wave 1 past-year cannabis use	491	1.6	167	0.9	49	0.9	46	3.8	229	3.5	<0.0001

Key: HS, high school; NH, non-Hispanic

¹The report of fewer than 100 lifetime cigarettes at the time of the Wave 1 assessment

²The report of 100 or more lifetime cigarettes and no smoking at the time of the Wave 1 assessment

³The report of 100 or more lifetime cigarettes and smoking cigarettes fewer than 7 days per week at the time of the Wave 1 assessment

⁴The report of 100 or more lifetime cigarettes and smoking cigarettes 7 days per week at the time of the Wave 1 assessment

⁵Met criteria at Wave 1 for a lifetime diagnosis of major depressive disorder, bipolar disorder, 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

⁶Met criteria at Wave 1 for a lifetime diagnosis of nicotine dependence or abuse/dependence of alcohol, sedatives, tranquilizers, opioids, heroin, amphetamines, cocaine, hallucinogens, inhalants/solvents, or other drugs.

Table 2:

Wave 1 past-year cannabis use and odds of cigarette smoking at Wave 2 among Wave 1 non-cigarette smokers

	Non-daily smoking at Wave 2 ^a		Daily smoking at Wave 2 ^a	
Wave 1 past-year cannabis use	OR	95% CI	OR	95% CI
OR1				
No past-year use	1.0	---	1.0	---
Past-year use	4.45	3.97–5.00	2.90	2.10–4.00
OR2				
No past-year use	1.0	---	1.0	---
Past-year use	2.04	1.79–2.32	1.38	1.02–1.86
OR3				
No past-year use	1.0	---	1.0	---
Past-year use	2.03	1.76–2.34	1.43	1.06–1.93
OR4				
No past-year use	1.0	---	1.0	---
Past-year use	1.85	1.59–2.16	0.99	0.60–1.63
OR5				
No past-year use	1.0	---	1.0	---
Past-year use	1.86	1.59–2.16	1.00	0.61–1.65

^aCompared with no cigarette smoking at Wave 2

OR1. Unadjusted estimates

OR2. Adjusted for demographic covariates

OR3. Adjusted for OR2 covariates + Wave 1 psychiatric disorders

OR4. Adjusted for OR3 covariates + Wave 1 alcohol and other drug use disorders

OR5. Adjusted for OR4 covariates + Wave 1 nicotine dependence

Key: CI, confidence interval; OR, odds ratio; PY, past year

Table 3:

Wave 1 past-year cannabis use and odds of cigarette smoking at Wave 2 among Wave 1 former cigarette smokers

	Non-daily smoking at Wave 2 ^a		Daily smoking at Wave 2 ^a	
Wave 1 past-year cannabis use	OR	95% CI	OR	95% CI
OR1				
No past-year use	1.0	---	1.0	---
Past-year use	5.24	3.74–7.34	4.18	3.01–5.81
OR2				
No past-year use	1.0	---	1.0	---
Past-year use	1.84	1.33–2.55	1.54	1.03–2.29
OR3				
No past-year use	1.0	---	1.0	---
Past-year use	1.89	1.34–2.65	1.47	1.00–2.16
OR4				
No past-year use	1.0	---	1.0	---
Past-year use	1.63	1.05–2.54	1.04	0.65–1.66
OR5				
No past-year use	1.0	---	1.0	---
Past-year use	1.64	1.06–2.53	1.06	0.67–1.68

^aCompared with former cigarette smoking at Wave 2

OR1. Unadjusted estimates

OR2. Adjusted for demographic covariates

OR3. Adjusted for OR2 covariates + Wave 1 psychiatric disorders

OR4. Adjusted for OR3 covariates + Wave 1 alcohol and other drug use disorders

OR5. Adjusted for OR4 covariates + Wave 1 nicotine dependence

Key: CI, confidence interval; OR, odds ratio; PY, past year

Table 4.

Wave 1 past-year cannabis use and odds of cigarette smoking at Wave 2 among Wave 1 daily cigarette smokers

	Non-daily smoking at Wave 2 ^a		No smoking at Wave 2 ^a	
Wave 1 past-year cannabis use	OR	95% CI	OR	95% CI
OR1				
No past-year use	1.0	---	1.0	---
Past-year use	1.32	1.09–1.59	0.57	0.51–0.64
OR2				
No past-year use	1.0	---	1.0	---
Past-year use	0.97	0.81–1.17	0.70	0.63–0.79
OR3				
No past-year use	ref	---	ref	---
Past-year use	1.07	0.89–1.28	0.77	0.69–0.87
OR4				
No past-year use	ref	---	ref	---
Past-year use	0.95	0.74–1.22	0.94	0.84–1.06
OR5				
No past-year use	1.0	---	1.0	---
Past-year use	0.97	0.75–1.24	0.97	0.86–1.09

^aversus Wave 2 daily smoking (ref)

OR1. Unadjusted estimates

OR2. Adjusted for demographic covariates

OR3. Adjusted for OR2 covariates + Wave 1 psychiatric disorders

OR4. Adjusted for OR3 covariates + Wave 1 alcohol and other drug use disorders

OR5. Adjusted for OR4 covariates + Wave 1 nicotine dependence

Key: CI, confidence interval; OR, odds ratio; PY, past year

Table 5.

Wave 1 past-year cannabis use and odds of cigarette use at Wave 2 among Wave 1 non-daily cigarette smokers

	Daily smoking at Wave 2 ^a		No smoking at Wave 2 ^a	
Wave 1 past-year cannabis use	OR	95% CI	OR	95% CI
OR1				
No past-year use	Ref	---	ref	---
Past-year use	0.79	0.61–1.03	0.88	0.70–1.10
OR2				
No past-year use	Ref	---	ref	---
Past-year use	0.75	0.56–0.99	1.03	0.81–1.31
OR3				
No past-year use	Ref	---	ref	---
Past-year use	0.76	0.57–1.02	1.06	0.82–1.36
OR4				
No past-year use	Ref	---	ref	---
Past-year use	1.02	0.68–1.53	1.33	0.96–1.84
OR5				
No past-year use	1.0	---	1.0	---
Past-year use	1.04	0.68–1.59	1.38	0.99–1.93

^aversus Wave 2 non-daily smoking (ref)

OR1. Unadjusted estimates

OR2. Adjusted for demographic covariates

OR3. Adjusted for OR2 covariates + Wave 1 psychiatric disorders

OR4. Adjusted for OR3 covariates + Wave 1 alcohol and other drug use disorders

OR5. Adjusted for OR4 covariates + Wave 1 nicotine dependence

Key: CI, confidence interval; OR, odds ratio; PY, past year