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Trajectories of Marijuana Use Beginning in Adolescence Predict Tobacco Dependence in Adulthood

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Abstract

Background—Although the “stage theory” suggests that marijuana use occurs after the initiation of tobacco smoking, substantial evidence exists that they occur concurrently, and that the use of marijuana may influence the use of tobacco.

Methods—This study uses trajectory analysis to examine the relationship between marijuana use and adult tobacco dependence in a 5-wave longitudinal study (mean ages in each wave: 14, 19, 24, 29, and 32). The sample consisted of 816 participants (52% African Americans, 48% Puerto Ricans), of whom 60 % were females. Logistic regression analyses were conducted to predict later tobacco dependence from earlier trajectories of marijuana use.

Results—A higher Bayesian posterior probability (BPP) for the chronic marijuana use trajectory group (OR=10.93, $p < .001$; AOR=10.40, $p < .001$), for the increasing marijuana use trajectory group (OR=6.94, $p < .001$; AOR=6.73, $p < .001$), and for the moderate marijuana use trajectory group (OR=3.13, $p < .001$; AOR=3.18, $p < .001$) was associated with an increased likelihood of being dependent on tobacco compared with the BPP of the no or low marijuana use trajectory group.

Conclusions—The results underscore the value of considering multiple patterns of marijuana use within a person-centered approach. Thus, it would be appropriate for marijuana cessation programs to incorporate the prevention, assessment, and cessation of tobacco use in their health promotion strategies.

INTRODUCTION

While several epidemiologic studies have examined gender, ethnicity, peer, and parental influences as predictors of regular smoking,^(1, 2) little attention has been given to the effects of marijuana use on smoking tobacco. Marijuana has seldom been considered a risk factor for smoking tobacco because of the prevailing notion that marijuana use occurs after the initial use of tobacco.^(3, 4) Although the “stage theory”^(5, 6) suggests that marijuana use occurs after the initiation of tobacco smoking, substantial evidence exists that they occur concurrently, and that use of one may influence use of the other. With the increasing prevalence of marijuana use among adolescents and tobacco users,⁽⁷⁾ characterizing the

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relationship between marijuana and tobacco dependence represents an important first step toward increasing understanding of the complex phenomenon of tobacco dependence.

Several investigators have reported an association between marijuana use and tobacco dependence.^(8, 9) Using cross-sectional data from the National Household Survey on Drug Abuse, Richter and colleagues have reported that marijuana users compared with non-users were over five times more likely to smoke cigarettes.⁽⁸⁾ Another cross-sectional study by Okoli and colleagues⁽⁹⁾ has reported that marijuana users were 5.9 times more likely to be current tobacco smokers and reported higher levels of perceived addiction to tobacco as compared with marijuana non-users. A longitudinal study by Patton et al.⁽¹⁰⁾ reported that young Australians who use cannabis daily had over a three-fold increase in the odds of becoming nicotine dependent.

Since depressive symptoms, low self-control, delinquency, cigarette use, alcohol use, other illicit drug use, gender, ethnicity, and age are also related to tobacco dependence,^(11–17) these variables are used as control variables as discussed in the section on analytic procedure. Specifically, Jamal et al.⁽¹¹⁾ reported that symptoms of depression were more severe in nicotine-dependent smokers than among never-smokers, former smokers, and non-dependent smokers. Low self-control has also been found to increase the likelihood of tobacco smoking.⁽¹²⁾ With regard to delinquency, early-onset delinquents showed an earlier onset and a faster rate of increase in the number of symptoms of nicotine dependence than late-onset delinquents and non-delinquents.⁽¹³⁾ A study of the frequency of smoking in the past week and nicotine dependence showed a higher prevalence of dependence at higher levels of cigarette use.⁽¹⁴⁾ Tobacco dependence occurred among older individuals, males, and among drinkers, smokers, and illicit drug users.^(12, 15, 16) Herzog and Pokhrel reported that there were ethnic differences in nicotine dependence.⁽¹⁷⁾

Several investigators have used trajectory-based models for the use of tobacco, alcohol, and marijuana.^(18, 19) We extend previous research,⁽²⁰⁾ which focused on the relationship between trajectories of marijuana use from adolescence to adulthood and work commitment in adulthood. In the present study, we examine the relation between earlier marijuana use and later tobacco dependence. An advantage of our approach is that it takes into consideration the timing and intensity of changes in marijuana use across individuals as related to tobacco dependence. Some individuals may begin using marijuana at an early age and escalate rapidly. Other individuals may be moderate users across several developmental stages. By focusing on these different developmental courses, person-centered approaches⁽²¹⁾ that identify homogeneous subgroups have an advantage over traditional “variable centered approaches” (e.g., regression analyses) that focus on average relations among variables. For instance, identifying homogeneous subgroups of marijuana users may assist in elucidating multiple pathways to tobacco dependence. However, to date, no studies have used trajectory-based models to examine the relation between earlier trajectories of marijuana use and later tobacco dependence beginning in early adolescence and extending to the fourth decade of life.

Our previous research⁽²⁰⁾ identified four trajectories of marijuana use: chronic users, increasing users, moderate users, and no or low users extending from adolescence (mean age

of 14) to early adulthood (mean age of 29). We hypothesize that: 1) the higher level of marijuana use trajectory groups (e.g., the chronic marijuana use trajectory group, the increasing marijuana use trajectory group, and the moderate marijuana use trajectory group) compared to the no or low marijuana use trajectory group will be associated with an increased likelihood of being dependent on tobacco use; and 2) early depressive symptoms, low self-control, delinquency, alcohol use, cigarette use, other illicit drug use, gender, ethnicity, and age in adolescence will not affect the association between the patterns of marijuana use and tobacco dependence.

METHODS

Participants

Participants who attended schools serving the East Harlem area of New York City in 1990 were surveyed longitudinally 5 times between 1990 and 2010. Data on the participants were first collected in 1990 (time 1; T1, N=1,332) when the participants were students. At T1, the questionnaires were administered in classrooms under the supervision of the study research staff with no teachers present. The mean age of participants at T1 was 14.1 years (Standard Deviation; SD=1.3 years; inter-quartile range from 13 to 15 years). At time 2 (T2; 1994 – 1996; N=1,190), the National Opinion Research Center located and interviewed the participants in person or by phone. The mean age of the participants at this wave was 19.2 years (SD=1.5 years; inter-quartile range from 18 to 20 years). At time 3 (T3; 2000 – 2001; N=662), the Survey Research Center of the University of Michigan interviewed the participants in person or by telephone. The mean age of the participants at T3 was 24.4 years (SD=1.3 years; inter-quartile range from 23 to 25 years). At Time 4 (T4) and Time 5 (T5), participants completed mailed questionnaires or were interviewed in person or by telephone by our research group. At T4 (2004 – 2006; N=838), the mean age was 29.2 years (SD=1.4 years; inter-quartile range from 28 to 30 years). At T5 (2007 – 2010; N=816), the average age of the participants was 32.3 years (SD= 1.3 years; inter-quartile range from 31 to 34 years). Among the 816 participants at T5, 52% were African Americans, and 48% were Puerto Ricans. Sixty percent were females (n=492).

The New York University School of Medicine's Institutional Review Board (IRB) approved the study for T4 and T5, and the IRBs of both the Mount Sinai School of Medicine and New York Medical College approved the study's procedures for data collections in the earlier waves. A Certificate of Confidentiality was obtained from the National Institute on Drug Abuse for T1-T4 and from the National Cancer Institute at T5. At T1 and T2, passive consent procedures were obtained from the parents of minors. At each time wave, we obtained informed assent or consent from all of the participants. Additional information regarding the study methodology is available from a previous report.⁽²⁰⁾

At T5, we attempted to follow-up all those who participated at T1. We compared the demographic variables for the 816 adults who participated at both T1 and T5 with the 516 who participated at T1 but not at T5. There were no significant differences between the T5 non-participants and the T5 participants in the proportion of African Americans and Puerto Ricans ($\chi^2(1) = 0.01, p = 0.9$), their use of alcohol at T1 ($t = -0.03, p = 0.9$), and their depressive symptoms at T1 ($t = 0.17, p = 0.8$). Also, there was no significant difference on

the measure of low self-control between the T5 non-participants and the T5 participants ($t = 0.15, p = 0.9$). However, the percentage of males among the T5 non-participants (57%) was significantly higher than the percentage of males who participated at T5 (40%) ($\chi^2(1) = 36.2, p < .001$). The mean age at T1 among T5 non-participants (14.2) was higher than the mean age at T1 among T5 participants (14.0) ($t = 2.13, p < .05$). The score of delinquency at T1 among T5 non-participants (0.6) was higher than the score of delinquency at T1 among the T5 participants (0.5) ($t = 2.65, p < .01$). The frequency of illicit drug use (other than marijuana) at T1 among T5 non-participants (0.08) was higher than the frequency of illicit drug use (other than marijuana) at T1 among the T5 participants (0.03) ($t = 2.55, p < .05$). On the other hand, the frequency of cigarette use at T1 among T5 non-participants (0.26) was lower than the frequency of cigarette use at T1 among the T5 participants (0.34) ($t = -2.11, p < .05$).

Measures

The variables used in this study are presented in Table 1.^(22–28) Tobacco dependence was assessed at T5 by the University of Michigan Composite International Diagnostic Interview (UM-CIDI). The questions were matched with the DSM-IV criteria.^(27, 28) As in DSM-IV, a positive diagnosis was obtained when at least three out of seven criteria listed in Table 1 were endorsed by the participant (See Table 1).

Analytic Procedure

We used a growth mixture model to obtain the trajectories of marijuana use from T1 to T4 using Mplus software.⁽²⁹⁾ Marijuana use at each point in time was treated as a censored normal variable. We calculated the average marijuana use score at each time point displayed in Figure 1. We applied the full information maximum likelihood approach for missing data.⁽²⁹⁾ We used the optimal Bayesian Information Criterion (BIC) to estimate the number of trajectory groups. Each participant was assigned to the trajectory group with the largest Bayesian posterior probability (BPP). The observed trajectories for a group were the averages of marijuana use at each point in time when the participants were assigned to the group with the largest BPP (see Figure 1).

To examine the associations of membership in a trajectory group, we used logistic regression analyses⁽³⁰⁾ that had tobacco dependence as a dependent variable and the BPP of membership in the trajectory groups as the independent variables. The BPP of the no or low marijuana trajectory group was used as a reference group. Also, we conducted pair-wise comparisons among the chronic, increasing, and moderate marijuana use trajectory groups (i.e., chronic vs. increasing, chronic vs. moderate, and increasing vs. moderate). T1 depressive symptoms, T1 low self control, T1 delinquency, T1 cigarette use, T1 alcohol use, T1 other illicit drug use, T1 gender, T1 ethnicity, and T1 age were used as control variables.

RESULTS

Among the 816 participants, 166 (20.3%) were diagnosed as tobacco dependent at T5. The mean and SD scores of marijuana use at each point in time were 0.2 (0.6), 0.8 (1.4), 1.2 (1.5), and 0.9 (1.5) for T1-T4, respectively. We computed solutions for two through five

trajectory groups. The BICs for each number of groups were: 2 (5849), 3 (5717), 4 (5653), and 5 (5662). We chose the four trajectory group model because it had the smallest BIC (See Figure 1). The statistics are presented in detail for the 4-group model (See Table 2). The mean BPP of the participants who were assigned to the groups ranged from 87% to 93%, which indicated an adequate classification.

As shown in Figure 1, we labeled the four marijuana use trajectory groups as follows. The no or low marijuana use trajectory group had an estimated prevalence of 64% and included participants who reported no or little use of marijuana at each wave. The increasing marijuana use trajectory group included participants who reported no use of marijuana at age 14, using marijuana from more than a few times a year (i.e., the average use score was 1.5) to less than monthly at age 19, and at least monthly but less than several times a month (i.e., the average use score was 2.5) at age 24 and age 29. This group had an estimated prevalence of 10%. The moderate marijuana use group included participants who reported no use of marijuana at age 14, but using marijuana a few times a year thereafter. This group had an estimated prevalence of 12%. The chronic marijuana use group included participants who reported no use of marijuana at age 14, using marijuana less than several times a month at age 19 (i.e., the average use score was 2.5), about once a week or more at age 24, and around several times a month at age 29. This group had an estimated prevalence of 14%. Table 3 contains the means with SD or percentages in each trajectory group for the variables in the study.

Table 4 presents: a) the odds ratios (OR) without the control variables and b) the adjusted odds ratios (AOR) in the comparisons between the marijuana trajectory groups (i.e., chronic vs. no or low, increasing vs. no or low, moderate vs. no or low, chronic vs. increasing, chronic vs. moderate, and increasing vs. moderate) for T5 tobacco dependence. In these analyses, the control variables included T1 depressive symptoms, T1 low self control, T1 delinquency, T1 alcohol use, T1 cigarette use, T1 other illicit drug use, gender, ethnicity, and age. Membership in the trajectory groups was significantly correlated with tobacco dependence at T5. A higher BPP for the chronic marijuana use trajectory group (OR=10.93, $p < .001$; AOR=11.07, $p < .001$), for the increasing marijuana use trajectory group (OR=6.94, $p < .001$; AOR=7.04, $p < .001$), and for the moderate marijuana use trajectory group (OR=3.13, $p < .001$; AOR=3.32, $p < .001$) was associated with an increased likelihood of being dependent on tobacco use compared with the BPP of the no or low marijuana use trajectory group. Also, a higher BPP for the chronic marijuana use trajectory group (OR=3.02, $p < .001$; AOR=2.86, $p < .01$) was associated with an increased likelihood of being dependent on tobacco use as compared with the BPP of the moderate marijuana use trajectory group. A higher BPP for the increasing marijuana use trajectory group (OR=2.03, $p < .05$) was associated with an increased likelihood of being dependent on tobacco use as compared with the BPP of the moderate marijuana use trajectory group.

DISCUSSION

As we hypothesized, the findings indicated that 1) the higher level marijuana use trajectory groups (e.g., the chronic marijuana use trajectory group, the increasing marijuana use trajectory group, and the moderate marijuana use trajectory group) compared to the no or

low marijuana use trajectory group were associated with an increased likelihood of being dependent on tobacco use; and 2) the findings were maintained with control on a number of variables including early depressive symptoms, low self-control, delinquency, alcohol use, cigarette use, other illicit drug use, gender, ethnicity, and age in adolescence.

Our findings confirm prior results in high-risk and school samples: namely, in some cases, marijuana use is associated with an increased likelihood of nicotine dependence.⁽³¹⁾ Even after controlling for earlier cigarette use, the results are partly in accord with those of Humfleet and Haas⁽³²⁾ in their longitudinal study. It may be that differences in the acceptability of marijuana use and nicotine play a role in this sequence in some individuals. The combined use of tobacco and marijuana is a cross-cultural phenomenon.⁽⁷⁾ In the United States, concurrent use of cigarettes and marijuana is common, as is the use of blunts.⁽⁷⁾ Blunts are made from marijuana rolled in the tobacco-leaf wrapper from a cigar.⁽³³⁾ In addition, young substance users commonly believe that marijuana use is a benign drug and a form of youthful experimentation which could reverse some of the harmful effects from smoking cigarettes.⁽³⁴⁾

The effects of early marijuana use on adult tobacco dependence may be explained in part by biological mechanisms. For example, cannabinoid receptor knockout mice, in contrast to wild-type mice, did not exhibit the rewarding effects of nicotine in a place preference test.⁽³⁵⁾ The results by Castañé et al.⁽³⁵⁾ suggest a modulating effect of the cannabinoid system on responses that are elicited by nicotine administration. In further support of this neurobiological basis, an investigational medication blocking the cannabinoid receptor CNR1 has shown efficacy in tobacco cessation treatment in humans.⁽³⁶⁾ This same medication blocks many of the effects of cannabis use.⁽³⁷⁾

Panlilio and colleagues⁽³⁸⁾ studied “gateway drug” effects in animal models of drug abuse. They found that THC exposure in rats increased the likelihood of nicotine self-administration and increased the value of nicotine reward. According to Pistis et al.,⁽³⁹⁾ exposure to cannabinoids in rodents is related to decreased reactivity of the dopamine neurons that affect the brain’s reward areas. Decreased reactivity may then be related to increased susceptibility to later drug abuse.⁽³³⁾ This research may partially explain our finding that increasing cannabis use in adolescence is associated with an increase in the likelihood of tobacco dependence. Initially, inversely applying these findings to humans, it may be that blocking cannabinoid receptors may decrease the rewarding effects of nicotine. One might speculate that decreasing marijuana use in adolescence may lead to a decrease in the likelihood of nicotine dependence later in life.

Several psychological processes may also be involved. For example, there is evidence that the use of marijuana is related to depressive symptoms.⁽⁴⁰⁾ Depressive symptoms have been associated with tobacco dependence.⁽¹¹⁾ In the current study, the association between the trajectories of marijuana use and tobacco dependence was maintained after controlling for depressive symptoms and a number of covariates (i.e., low self-control, delinquency, tobacco use, alcohol use, other illicit drug use, gender, ethnicity, and age) at T1.

In this study, the participants who were in the chronic and increasing marijuana use trajectory groups decreased their marijuana use beginning at age 24. These findings are in accord with those of Bachman and colleagues who reported that many individuals decrease their marijuana use from the mid-twenties to the early thirties.⁽⁴¹⁾ However, these individuals may continue to smoke cigarettes. According to Bachman et al.,⁽⁴¹⁾ some adults are more likely to use drugs as a result of having a more unconventional life style. According to Jessor et al.⁽⁴²⁾ unconventionality is a dimension encompassing drug prone attributes and includes such factors as tolerance of deviance, delinquent behavior, and low religiosity. The unconventional life style may in turn be related to stress. Marijuana use has been related to adverse effects on employment, impaired cognitive processes, psychiatric problems, physical illness, and low health care utilization.⁽⁴³⁾

Limitations

This research has several limitations. First, the sample consisted of African American and Puerto Rican inner city adolescents studied until the early 30s. Consequently, the linkage between the trajectories of marijuana use and tobacco dependence may not apply to the general population. However, the percentage of adult tobacco dependence in our sample was 20.3%. In comparison among young adults in the United States, 21.7% were dependent on nicotine.⁽²⁾ Further studies should include other ethnic groups. Also, we are limited in our ability to generalize our findings to the general population due to the differences between T5 respondents and T5 non-respondents. Second, our data are also based on self-reports. However, studies have shown that the use of this type of self-report data yields reliable results.⁽⁴⁴⁾ Third, we did not assess developmental longitudinal changes such as changes in the prefrontal cortex during adolescence and the 30s. These biological changes may lead to improvements in executive functioning such as impulse-control and planning and ultimately refraining from becoming dependent on tobacco use. Fourth, we cannot conclude that there is a causal relationship between marijuana use and tobacco dependence. However, we can conclude that in some cases there was an association between earlier marijuana use and later tobacco dependence. Furthermore, it may be that the relationship is driven by correlated unobserved characteristics that contribute to making an individual more likely to use both marijuana and tobacco. For example, it is possible that there is a genetic predisposition that protects individuals who initiate marijuana or tobacco use from becoming addicted.

Despite these limitations, the study supports and adds to the literature in a number of ways. First, we assess the predictors of tobacco dependence among relatively understudied ethnic groups of African Americans and Puerto Ricans living in an urban area of New York City. Second, we follow our adolescent sample longitudinally up to the mean age of 32, in contrast to the majority of prior research, which has been conducted upon samples either of adolescents or young adults. Third, we identify the trajectories of marijuana use covering several developmental stages spanning a 15 year period as predictors of tobacco dependence.

Conclusions

From a public health perspective, diminishing chronic, increasing, and moderate marijuana use may reduce tobacco dependence. The findings by Hu and colleagues support our

conclusions.⁽⁴⁶⁾ In light of the results, policy makers should consider the effects of different amounts of marijuana use in their approach to tobacco dependence. Prevention and treatment in early adolescence should focus on decreasing the chronic marijuana use trajectory group, the increasing marijuana use trajectory group, and the moderate marijuana use trajectory group through prevention and treatment programs.⁽⁴⁵⁾ If the prevention and treatment programs are successful, this may result in a decrease in tobacco dependence in adulthood.

In addition to focusing on the trajectories of marijuana use, prevention of tobacco dependence should target early tobacco use.^(47,48) Thus, it may be prudent for marijuana cessation programs to incorporate the prevention, assessment, and cessation of tobacco use in their health promotion strategies.

Future research is necessary to examine the association of the trajectories of marijuana use with tobacco dependence using larger and more diverse samples of individuals at different developmental stages. This research is a first step in realizing this potential. Only then can more useful interventions to reduce tobacco dependence tailored to the individual's stage of development and concurrent marijuana use be designed and implemented.

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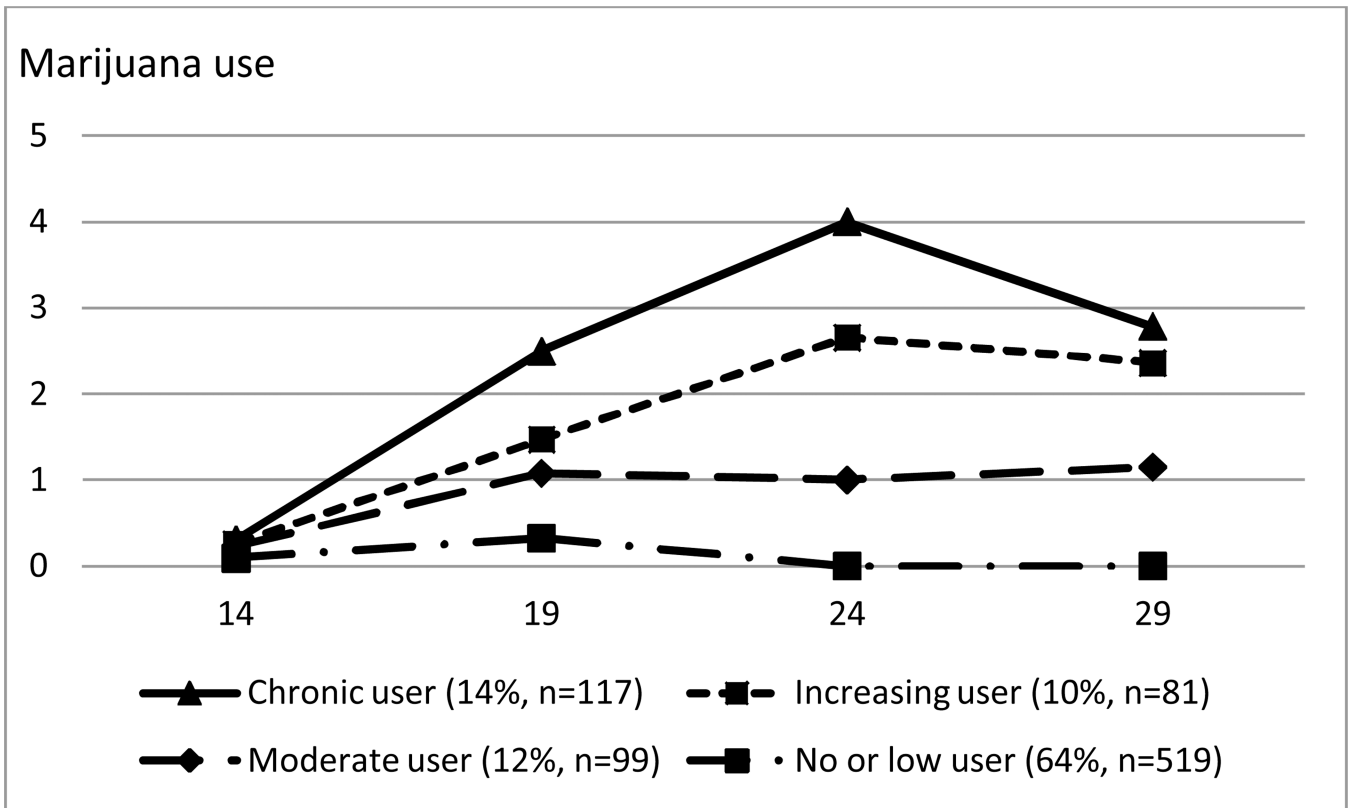


Fig. 1.
 Developmental Trajectories of Marijuana Use Extending from Adolescence to age 29
 Note: 0 = never; 1 = a few times a year or less; 2 = about once a month; 3 = several times a month; 4 = once a week or more

TABLE 1

Measures

Variables	No. of items	α or r	Sample item	Answer options
<i>Demographic variables (T1)</i>				
Gender	1	NA		Female (1), male (2)
Ethnicity	1	NA	What is your ethnicity?	African American (1), Puerto Rican (2)
Age	1	NA	What is your age?	NA
<i>Control Variables (T1)</i>				
Depressive symptoms ⁽²²⁾	2	$r = .47$	Do you sometimes feel unhappy, sad, or depressed?	not at all (0), somewhat (1), mostly (2), extremely (3)
Low self-control ⁽²³⁻²⁵⁾	8	$\alpha = .78$	Do you enjoy doing things you should not, just for the fun of it?	completely false (1), mostly false (2), mostly true (3), completely true (4)
Delinquency ⁽²⁶⁾	10	$\alpha = .75$	During the last 5 years, how often have you gotten into a serious fight?	never (0), once (1), twice (2), three or four times (3), five or more times (4)
Alcohol use	1	NA	How much do you drink beer, wine, or hard liquor?	none (0), less than once a week (1), once a week to several times a week (2), one or two drinks every day (3), three or more drinks every day (4)
Cigarette use	1	NA	How many cigarettes do you smoke?	none (0), a few cigarettes or less a week (1), 1-5 cigarettes a day (2), 1/2 a pack a day (3), about 1 pack a day (4), more than one pack a day (5)
Illicit drug use other than marijuana	1	NA	How often have you used cocaine, crack, ecstasy, etc.?	never (0), a few times a year or less (1), about once a month (2), several times a month (3), once a week or more (4)
<i>Independent Variable (T1-T4)</i>				
Marijuana use	1	NA	How often have you ever used marijuana?" at T1 and "How often have you used marijuana in the past 5 years?" at T2, T3, and T4	Same as the options of illicit drug other than marijuana
<i>Dependent Variable (T5)</i>				
Tobacco dependence ^(27,28)	7	NA	1) physical tolerance, 2) signs of withdrawal when the subject refrained from smoking, 3) smoking in larger amounts and/or over a longer period than intended, 4) unsuccessful attempts to cut down or control the amount of smoking, 5) a large amount of time spent smoking (e.g., chain-smoking), 6) giving up or reducing social, occupational, or recreational activities due to smoking, and 7) continuing smoking despite knowing it has caused mental or physical health problems.	no (0), yes (1)

Note. α = Cronbach's alpha, r = inter-item correlation, NA = not applicable, T1= time 1 (age 14), T4 = time 4 (age 29), T5 = time 5 (age 32)

TABLE 2

Statistics for the 4-group model of marijuana use

Parameter	Estimate (Standard Error)			
	No or low marijuana use	Increasing marijuana use	Moderate marijuana use	Chronic marijuana use
Marijuana use				
Intercept	-5.90 (0.50) ***	-3.79 (0.65) ***	-4.03 (0.57) ***	-3.71 (0.56) ***
Slope	4.18 (0.64) ***	5.91 (0.62) ***	4.68 (0.52) ***	7.34 (0.51) ***
Quadratic coefficient	-1.21 (0.17) ***	-1.35 (0.16) ***	-1.08 (0.13) ***	-1.74 (0.12) ***

Note. *** $p < .001$

TABLE 3

Means (standard deviation) or percentages in variables by marijuana use trajectory group

	Marijuana Trajectory Groups					Whole sample
	No or low users (64%, n=519)	Increasing users (10%, n=81)	Moderate users (12%, n=99)	Chronic users (14%, n=117)		(N=816)
<i>Demographic variables</i>						
Females	68% (n=353)	48% (n=39)	57% (n=56)	38% (n=44)		60% (n=324)
African-American	53% (n=276)	54% (n=44)	48% (n=48)	49% (n=57)		52% (n=425)
Age (T1)	14.09 (1.33)	14.19 (1.33)	13.89 (1.27)	13.65 (1.11)		14.01 (1.30)
<i>Control variables</i>						
Depressive symptoms (T1)	1.60 (0.89)	1.69 (0.92)	1.66 (0.83)	1.70 (0.92)		1.63 (0.89)
Low self-control (T1)	2.10 (0.61)	2.39 (0.61)	2.29 (0.61)	2.46 (0.62)		2.20 (0.62)
Delinquency (T1)	0.42 (0.44)	0.66 (0.60)	0.59 (0.63)	0.81 (0.67)		0.52 (0.54)
Alcohol use (T1)	0.28 (0.44)	0.32 (0.42)	0.38 (0.55)	0.48 (0.47)		0.33 (0.46)
Cigarette use (T1)	0.30 (0.70)	0.37 (0.71)	0.48 (0.82)	0.43 (0.76)		0.34 (0.73)
Illicit drug use other than marijuana (T1)	0.03 (0.17)	0.04 (0.25)	0.02 (0.20)	0.07 (0.33)		0.03 (0.21)
<i>Outcome variable at T5</i>						
Tobacco dependence	10% (n=52)	37% (n=30)	24% (n=24)	51% (n=60)		20% (n=166)

Note. Answer options for depressive symptoms ranged from "not at all (0)" to "extremely (3)." Answer options for low self-control ranged from "completely false (1) to completely true (4)." Answer options for delinquency ranged from "never (0)" to "five or more times (4)." Answer options for alcohol use ranged from "none (0)" to "three or more drinks every day (4)." Answer options for cigarette use ranged from "none (0)" to "more than one pack a day (5)." Answer options for illicit drug use other than marijuana ranged from "never (0)" to "once a week or more (4)."

TABLE 4

Odds Ratios (OR) and Adjusted Odds Ratios (AOR) for Marijuana Use Trajectories (T1–T4) as Related to Tobacco Dependence at T5 (N=816)

Marijuana Use Trajectory	T5 Tobacco Dependence	
	OR (95% CI)	AOR (95% CI)
Chronic users vs. No or low users	10.93 (6.51, 18.35) ***	11.07 (6.07, 20.21) ***
Increasing users vs. No or low users	6.94 (3.92, 12.28) ***	7.04 (3.72, 13.33) ***
Moderate users vs. No or low users	3.13 (1.72, 5.69) ***	3.32 (1.75, 6.29) ***
Chronic users vs. Increasing users	1.60 (0.86, 2.99)	1.79 (0.89, 3.62)
Chronic users vs. Moderate users	3.02 (1.62, 5.61) ***	2.86 (1.46, 5.60) **
Increasing users vs. Moderate users	2.03 (1.03, 4.02) *	2.03 (0.95, 4.31)

Note: 1. * $p < .05$, ** $p < .01$, *** $p < .001$;

2. OR = Odds ratios without controls;

3. AOR = Adjusted odds ratios by including depressive symptoms, low self-control, delinquency, tobacco use, alcohol use, other illicit drug use, gender, ethnicity, and age at T1 as controls.