Passing on Pot: High School Seniors' Reasons for Not Using Marijuana as Predictors of Future Use

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ABSTRACT. Objective: Marijuana use is relatively common among youth and increases during the transition to adulthood. Yet a substantial number of adolescents and young adults do not use marijuana. The purpose of this study was to examine how high school seniors' reasons for intending not to use marijuana within the next 12 months were prospectively associated with marijuana use reported 1 year later. **Method:** Data were drawn from national longitudinal samples of U.S. high school seniors from the Monitoring the Future study ($n = 3,044$; 50% female; 65% White). Bivariate and multivariable logistic regression analyses were conducted to examine associations between reasons seniors indicated for intending not to use marijuana within the next 12 months and marijuana use reported 1 year later in the follow-up survey, controlling for sociodemographic characteristics and high school risk factors. Analy-

ses were conducted separately among youth with and without lifetime marijuana use in high school. **Results:** In multivariable models, reasons associated with marijuana abstinence 1 year later among prior marijuana use abstainers were concerns about becoming addicted, use being against ones' beliefs, not liking marijuana users, and not having friends who use marijuana. Among prior marijuana users, not enjoying marijuana was a significant predictor of marijuana abstinence 1 year later. **Conclusions:** Reasons for abstaining from marijuana have predictive utility in relation to later use, but these associations differ between those with and without prior marijuana use. Understanding the underlying reasons for stopping marijuana use or maintaining abstinence may inform youth substance use prevention and intervention programs. (*J. Stud. Alcohol Drugs*, 79, 761–769, 2018)

MARIJUANA IS THE MOST COMMONLY USED illicit drug in the United States. In 2016, 12-month marijuana prevalence was 38% among high school seniors and 55% among 19- to 20-year-olds (Miech et al., 2017a; Schulenberg et al., 2017). Negative consequences of marijuana use have been identified within multiple domains of functioning (Hall, 2015; Volkow et al., 2014, 2016). Acute effects of marijuana use may include altered perception and impaired motor coordination (e.g., Sewell et al., 2013; Hartman & Huestis, 2013, respectively). Paranoia, panic attacks, and psychotic symptoms may also occur after marijuana use, particularly among naive users and in high doses (e.g., D'Souza et al., 2004). Longer-term effects of marijuana use may include cognitive deficits, low educational attainment, adult cannabis use disorders, and altered brain function involved in reward processing and emotional functioning (Gruber et al., 2012; Maggs et al., 2015; Schulenberg et al., 2015; Martz et al., 2016; Heitzeg et al., 2015, respectively).

Examining the underlying reasons for marijuana use provides valuable insight regarding how young people decide about continued use through development. Youth report

numerous reasons for marijuana use, ranging from social to somatic domains (e.g., Lee et al., 2007; Patrick et al., 2011, 2016). Among national samples of youth ages 19 and 20 years old, Patrick et al. (2016) found that reasons pertaining to coping and to get high were most strongly associated with continued marijuana use and cannabis use disorder 15 years later. Far less attention, however, has been given to understanding why youth do not use marijuana and whether reasons for non-use are associated prospectively with later use. This gap in the literature is troublesome, considering that understanding reasons for abstaining from marijuana can help inform prevention and intervention efforts by identifying specific motivational targets for reducing problem marijuana use (Swan et al., 2008).

Theoretical models of decision-making that link beliefs and behaviors have been used to describe individuals' reasons as behavioral predictors of substance use, including marijuana use (e.g., Budd et al., 1983; Halpern-Felsher, 2009). The theory of reasoned action (TRA) posits that intentions to engage in a behavior are dependent on positive or negative attitudes and perceived social norms pertaining to that behavior (Ajzen & Fishbein, 2005; Fishbein & Ajzen,

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1975). The theory of planned behavior (TPB) extends TRA by adding perceived behavioral control as an influence on behavioral intentions (Ajzen, 1980). Related to TRA/TPB, Social Cognitive Theory (SCT) is a theoretical perspective on behavioral decision-making that emphasizes reciprocal interactions between behavioral, personal, and environmental factors (Bandura, 1986). In SCT, self-efficacy—a facet of personal agency that describes one's beliefs regarding their ability to successfully achieve a goal (Bandura, 2001)—directly affects the probability of obtaining a behavioral goal. For example, among samples of cannabis-dependent outpatients, greater levels of refusal self-efficacy were significantly associated with better treatment outcomes (Gullo et al., 2017), and increases in self-efficacy to refrain from marijuana use among cannabis-dependent outpatients significantly predicted marijuana abstinence 12 months post-treatment (Litt et al., 2008). The aforementioned intervention studies demonstrate that cognitions about abstaining from marijuana use have the potential to contribute to later use behavior.

However, no study to date—spanning both youth and adult ages—has examined specific reasons for marijuana non-use as predictors of later use. Existing research has focused instead on identifying the most frequently reported abstinence reasons among youth: perceived or experienced negative effects, lack of interest, personal beliefs, and peer influences (Anderson et al., 2015; Fountain et al., 1999; Terry-McElrath et al., 2008). Fountain et al. (1999) found that, among a community sample of youth ranging from 13 to 22 years of age (mean age 18 years), the most frequently endorsed reasons for marijuana non-use were being uninterested in marijuana and fear of its effects. In a more recent study, but also using a community sample, Anderson et al. (2015) investigated reasons for marijuana use and non-use among youth from early adolescence through early adulthood as predictors of marijuana use and associated problems at age 25; this study only examined the number of reasons rather than specific types of reason for non-use, finding that endorsing a greater number of abstinence motives was associated with less marijuana use and fewer marijuana problems in young adulthood.

In a study that assessed reason type, Dash and Anderson (2015) examined which motives to use and to abstain from marijuana were related to the intention, desire, and self-efficacy to quit among a sample of high school students identified as marijuana users. Reasons related to negative consequences and personal and peer beliefs were found to be associated with intentions to quit marijuana. However, this study identified motivational factors for potential future marijuana use rather than directly measuring reported use later in development. Furthermore, this study included only individuals who had prior experience using marijuana. It is important to differentiate between reasons for marijuana non-use among youth who are stopping use versus main-

taining abstinence. Reasons for quitting marijuana use may be most relevant for treatment programs aimed at reducing marijuana use; reasons for continuing to abstain may be useful for prevention programs geared toward youth at risk for later marijuana use but who have not yet initiated use.

Youth who intend to stop using marijuana have been found to report legal and employment problems as key reasons to stop use (Weiner et al., 1999) and perceive marijuana use as a detriment to their self-image (Rosenberg et al., 2012). Terry-McElrath et al. (2008) examined the extent to which national cross-sectional samples of high school seniors from the Monitoring the Future (MTF) study reported various categories of reasons for marijuana non-use and also examined differences in reasons reported by high school seniors with and without prior marijuana use. Never users were more likely to report social reasons (e.g., not wanting to be with marijuana users, friends not using) and marijuana use being against their beliefs as reasons for abstaining, compared to those with prior marijuana use. This work, however, is limited by not testing how specific reasons for intending not to use marijuana were associated with later use.

The present study also uses U.S. national data from MTF and builds on the aforementioned studies on reasons for marijuana non-use by examining: (a) the most frequently endorsed reasons for intending not to use marijuana within the next 12 months among high school senior cohorts from 1977 to 2012 with and without prior histories of marijuana use (i.e., lifetime abstainers vs. lifetime users); and (b) the extent to which reasons for marijuana non-use predicted any versus no marijuana use reported 12 months later among lifetime abstainers and lifetime users. Lifetime abstainers and users were examined separately due to the latter being more likely to have experienced the psychotropic and physiological effects of marijuana use. This difference may affect endorsement of reasons for marijuana non-use related to these consequences (e.g., Copersino et al., 2006; Terry-McElrath et al., 2008). Assessing reasons for continuing to abstain from or quit marijuana use, and how those reasons are prospectively associated with later use, will provide more specific guidance for the development of prevention and intervention protocols aimed at reducing adolescents' marijuana use.

Method

Participants and procedures

MTF is an ongoing epidemiological and etiological study of substance use among youth in the United States (Miech et al., 2017a; Schulenberg et al., 2017). Every year since 1975, MTF has surveyed nationally representative samples of approximately 15,000 high school seniors (modal age of 18) through self-administered questionnaires completed in the classroom. Respondents are selected through a three-stage

TABLE 1. Sample characteristics among participants intending not to use marijuana within the next 12 months

Variable	Total sample %	Lifetime abstainers %	Lifetime users %	χ^2 or t
Total sample		69.84	30.16	
Reporting any past-12-month marijuana use				
Baseline (modal age 18)	17.63	0.00	55.62	-40.16***
Follow-up (modal age 19)	19.60	9.26	45.05	-20.46***
Sociodemographic characteristics				
Male	50.51	49.73	51.95	2.67
White	65.38	65.25	66.52	0.93
Black	14.70	15.16	13.27	3.73
Hispanic	10.84	9.99	12.54	8.70**
Asian	3.67	4.52	1.75	28.20***
Other race/ethnicity	5.41	5.08	5.92	1.78
High parent education	63.65	65.59	59.94	18.28***
1977–1991 cohort	35.65	33.07	41.34	40.48***
1992–1997 cohort	16.85	18.55	13.04	29.49***
1998–2006 cohort	27.67	28.21	27.18	0.71
2007–2012 cohort	19.83	20.17	18.43	2.60
High school risk and protective factors				
4-year college plans	49.76	53.79	41.29	81.70***
B- or higher	77.82	80.88	71.24	72.55***
Cut class	26.38	21.40	36.75	156.54***
Evenings out	44.81	40.82	52.90	79.35***

Notes: Weighted sample size of participants reporting intent to probably or definitely not use marijuana within the next 12 months $n = 3,044$; χ^2 or t value comparisons between lifetime abstainers and lifetime users.

** $p < .01$; *** $p < .001$.

probability sampling procedure, in which geographic areas, schools in each geographic area, and specific classes within each school are randomly selected. Less than 1% of students refuse to complete the questionnaire, and nonresponse is predominantly due to absenteeism on the day of data collection. A representative sample of approximately 2,450 high school seniors who participated in the baseline survey each year are randomly selected for follow-up assessments through mailed questionnaires. One half of these panel samples are randomly selected to begin receiving biennial surveys 1 year after high school (modal age of 19), and the other half 2 years after high school (modal age 20). Attrition from baseline to follow-up assessments is attributable primarily to undeliverable or unreturned mailed questionnaires. Sixty-eight percent of high school seniors from the 1977–2012 senior year baseline cohorts responded 1 year later (at modal age 19) to the follow-up survey. Attrition weights were included in the present study to account for items measured at the baseline survey (e.g., substance use, sex) differentially associated with attrition at follow-up (McCabe et al., 2017; Schulenberg et al., 2015). Survey design and sampling methods are described in greater detail elsewhere (Miech et al., 2017a; Schulenberg et al., 2017). Informed consent was obtained, and all procedures are reviewed and approved on an annual basis by the University of Michigan's Institutional Review Board (IRB) for compliance with federal guidelines for the treatment of human subjects.

Since 1977, reasons for marijuana non-use have been included on one of the six MTF questionnaire forms. Forms were distributed randomly during the senior year administration, and respondents received the same form in follow-up surveys. Because the present study was designed to test whether reasons for intending not to use marijuana within the next 12 months predicted marijuana use reported 1 year later, the sample included only high school seniors who reported that they probably or definitely would not use marijuana within the next 12 months and responded to the follow-up survey 1 year later at modal age 19. Only respondents who reported intending not to use marijuana within the next 12 months were included in the present study, because only these respondents completed questionnaire items on reasons for marijuana non-use. Thus, the analytic sample included 3,044 respondents from the 1977–2012 senior year cohorts. Sample characteristics are provided in Table 1. Supplemental Table A provides descriptive information on youth who indicated that they probably or definitely would versus probably or definitely would not use marijuana within the next 12 months.

Measures

Marijuana use and intentions for non-use. Past-12-month marijuana use was assessed at both baseline and follow-up with a self-reported, single ordinal item. Respondents were

TABLE 2. Endorsed reasons for marijuana non-use at baseline and bivariate associations with any past-12-month marijuana use at follow-up

Reason for marijuana non-use at baseline	12-month marijuana use at follow-up								
	Full sample			Lifetime abstainers			Lifetime users		
	%	OR	[95% CI]	%	OR	[95% CI]	%	OR	[95% CI]
Negative consequences									
Concerned about possible psychological damage	60.21	0.45***	[0.39, 0.53]	66.53	0.65**	[0.49, 0.84]	47.34	0.55***	[0.46, 0.73]
Concerned about possible physical damage	58.32	0.49***	[0.42, 0.57]	65.08	0.67**	[0.52, 0.87]	44.88	0.68**	[0.54, 0.86]
My parents would disapprove	57.90	0.64***	[0.54, 0.74]	60.92	0.81	[0.63, 1.05]	51.93	0.73***	[0.58, 0.92]
It might lead to stronger drugs	50.39	0.56***	[0.48, 0.65]	56.04	0.73*	[0.57, 0.95]	39.15	0.70**	[0.55, 0.89]
Concerned about becoming addicted to marijuana	48.72	0.45***	[0.38, 0.53]	55.09	0.57***	[0.44, 0.73]	35.29	0.66**	[0.52, 0.85]
Concerned about possible loss of control of myself	47.74	0.49***	[0.42, 0.58]	53.41	0.59***	[0.46, 0.76]	35.91	0.60***	[0.47, 0.77]
Concerned about getting arrested	48.50	0.94	[0.80, 1.09]	49.50	1.01	[0.79, 1.31]	46.20	1.02	[0.81, 1.29]
Concerned about loss of energy or ambition	37.61	0.75**	[0.64, 0.89]	39.85	0.83	[0.64, 1.08]	33.15	0.92	[0.72, 1.18]
My husband/wife (or boyfriend/girlfriend) would disapprove	31.78	0.89	[0.75, 1.05]	31.84	0.70*	[0.52, 0.94]	32.46	0.91	[0.71, 1.16]
I might have a bad trip	22.88	0.65***	[0.54, 0.80]	24.51	0.89	[0.66, 1.20]	19.73	0.59***	[0.44, 0.80]
Lack of interest/impractical									
Don't feel like getting high	62.28	0.72***	[0.61, 0.84]	63.66	0.74*	[0.57, 0.96]	60.29	0.74*	[0.59, 0.94]
Not enjoyable, I didn't like it	27.50	1.23*	[1.04, 1.46]	20.79	0.89	[0.64, 1.24]	42.16	0.52***	[0.41, 0.66]
Too expensive	22.13	0.86	[0.72, 1.04]	22.58	0.79	[0.57, 1.08]	21.50	0.89	[0.68, 1.17]
Not available	6.15	0.72	[0.50, 1.03]	7.72	0.77	[0.45, 1.34]	3.09	1.34	[0.72, 2.50]
Personal beliefs/peer influences									
It's against my beliefs	46.88	0.33***	[0.28, 0.40]	57.62	0.49***	[0.38, 0.64]	24.87	0.65**	[0.50, 0.84]
I don't like being with the people who use it	41.13	0.32***	[0.27, 0.39]	48.90	0.37***	[0.28, 0.49]	25.13	0.56***	[0.42, 0.73]
My friends don't use it	32.89	0.37***	[0.31, 0.45]	39.87	0.42***	[0.31, 0.56]	18.97	0.74*	[0.55, 0.99]

Notes: Weighted sample size of lifetime abstainers $n = 2,126$. Weighted sample size of lifetime users $n = 918$. Modal age at baseline was 18 years. Modal age at follow-up was 19 years. OR = odds ratio; CI = confidence interval.

* $p < .05$; ** $p < .01$; *** $p < .001$.

asked, "On how many occasions (if any) have you used marijuana (weed, pot) or hashish (hash, hash oil) during the last 12 months?" Response options were 1 = 0 occasions, 2 = 1–2 occasions, 3 = 3–5 occasions, 4 = 6–9 occasions, 5 = 10–19 occasions, 6 = 20–39 occasions, or 7 = 40 or more occasions. Past-12-month marijuana use was dichotomized as 1 = any use occasions or 0 = no use occasions. To assess intentions to use marijuana within the following year, respondents were asked, "How likely is it that you will use marijuana in the next 12 months?" Response options were 1 = definitely will, 2 = probably will, 3 = probably will not, or 4 = definitely will not.

Reasons for marijuana non-use. Respondents who indicated that they probably or definitely would not use marijuana in the next 12 months (response options 3 and 4, respectively) were then instructed on the survey form, "Here are some reasons people give for not using marijuana, or for stopping use. Please tell us which reasons are true for you. (Mark all that apply)." Response options included 17 possible reasons for marijuana non-use, which are shown in Table 2. Tetrachoric correlations between reasons for marijuana non-use are provided in Supplemental Table B. Reasons were categorized as Negative Consequences, Lack of Interest/Impractical, and Personal Beliefs/Peer Influences, as identified in previous analyses using MTF survey data (Terry-McElrath et al., 2008).

Sociodemographic characteristics. Sex was coded as 1 = male or 0 = female. Race/ethnicity was coded as White (reference group), Black, Hispanic, Asian, or other. The "other"

race/ethnicity group included respondents who identified as Native American/Native Alaskan, Native Hawaiian/Pacific Islander, or multiple races/ethnicities. Parental education was measured by the highest level of education obtained by at least one parent, coded as 1 = some college education or more or 0 = high school degree or less. Cohorts were divided into four groups based on linear microtrends in past-12-month marijuana use over time (Jager et al., 2013): 1 = 1977–1991 (reference group), 2 = 1992–1997, 3 = 1998–2006, and 4 = 2007–2012.

High school risk and protective factors. To account for risk and protective factors for substance use among high school seniors identified in prior studies using data from MTF (e.g., Maggs et al., 2015; Martz et al., 2015; Patrick et al., 2013), the following items were included as covariates—(a) grades: measured by grade point average (GPA) in the current school year, coded as 1 = B- or higher and 0 = C+ or lower; (b) college plans: coded as 1 = definitely planning to graduate from a 4-year college or 0 = planning on less than a 4-year college education; (c) cutting class (i.e., missing without an excuse): coded as 1 = at least one class cut in the previous 4 weeks or 0 = no classes cut; and (d) evenings out for fun and recreation during a typical week: coded as 1 = three or more evenings out or 0 = less than three evenings out.

Analysis plan

To test which reasons for marijuana non-use reported at senior year were prospectively associated with marijuana

use at follow-up 12 months later, and how those reasons may differ between lifetime abstainers and lifetime users, bivariate and multivariable logistic regression analyses were performed using SAS Version 9.4 (SAS Institute, Cary, NC). The outcome measure of past-12-month marijuana use was dichotomized as 1 = *any use* versus 0 = *no use* reported at follow-up among respondents intending to probably or definitely not use marijuana (see Supplemental Table A). In these analyses, statistical procedures were used to account for the complex sample design of MTF surveys. Reasons for marijuana non-use that were significantly associated with future marijuana use for either lifetime abstainers or lifetime users in bivariate analyses were then tested in multivariable logistic regression analyses predicting marijuana use, controlling for sociodemographic characteristics and high school risk and protective factors for substance use. Multivariable logistic regression analyses were conducted separately for lifetime abstainers and lifetime users in order to account for the influence of (or lack thereof) their prior experiences with marijuana on perceptions of use.

Results

Sample characteristics

As shown in Table 1, approximately 30% of respondents had used marijuana by their senior year of high school (i.e., lifetime users), with nearly 70% reporting no prior marijuana use (i.e., lifetime abstainers). Note that our sample here only includes those who indicated that they probably or definitely would not use marijuana in the next 12 months, because only these respondents completed questionnaire items on reasons for marijuana non-use. Lifetime abstainers and users did not differ significantly in relation to sex, identifying as White, Black, or other race/ethnicity, or being in the 1998–2006 or 2007–2012 cohorts. Compared with lifetime users, the lifetime abstainers were more likely to identify as Asian (vs. White), to be in the 1992–1997 (vs. 1977–1991) cohort, and to have parent(s) with college education (vs. less than college education); they were less likely to identify as Hispanic (vs. White) and to be in the 1977–1991 cohort (vs. 1992–1997, 1998–2006, and 2007–2012 cohorts). Among high school risk and protective factors, lifetime abstainers were significantly more likely to have 4-year college plans and higher grades, and significantly less likely to cut class and have multiple evenings out with friends per week, compared with lifetime users.

Reasons for marijuana non-use and bivariate associations with marijuana abstinence at follow-up

Lifetime marijuana abstainers. As shown in Table 2, “Concerned about possible psychological damage” within the Negative Consequences category was the overall most

frequently endorsed reason for marijuana non-use among lifetime abstainers, with two thirds endorsing this reason. “Don’t feel like getting high” was the most frequently endorsed reason in the Lack of Interest/Impractical category, and “Against my beliefs” was the most frequently endorsed reason in the Beliefs/Peer Influences category. In regard to bivariate associations with marijuana use 1 year later, reasons within the Negative Consequences category significantly associated with any versus no marijuana use at follow-up were “Concerned about possible psychological damage,” “Concerned about possible physical damage,” “Concerned about becoming addicted to marijuana,” “Concerned about possible loss of control of myself,” “It might lead to stronger drugs,” and “My husband/wife (or boyfriend/girlfriend) would disapprove.” In the Lack of Interest/Impractical category, only “Don’t feel like getting high” was significantly associated with marijuana abstinence at follow-up. All reasons in the Personal Beliefs/Peer Influences category were associated with marijuana abstinence at follow-up.

Lifetime marijuana users. Among lifetime marijuana users, “Don’t feel like getting high” was the most frequently endorsed reason for marijuana non-use overall and in the Lack of Interest/Impractical category, with about 60% endorsing this reason. “Concerned about possible psychological damage” was the most frequently endorsed reason in the Negative Consequences category, and “I don’t like being with the people who use it” had the greatest endorsement in the Personal Beliefs/Peer Influences category. Significant bivariate associations between reasons for marijuana non-use in the Negative Consequences category and marijuana abstinence at follow-up were the same as for lifetime abstainers except for “My parents would disapprove” and “My husband/wife (girlfriend/boyfriend) would disapprove,” which were not significant among lifetime users; and “I might have a bad trip” was significant among lifetime users. In the Lack of Interest/Impractical category, “Don’t feel like getting high” and “Not enjoyable, I didn’t like it” were significant predictors of marijuana abstinence at follow-up. Although the percentages of respondents endorsing reasons in the Personal Beliefs/Peer Influences category was lower for lifetime users compared with abstainers, all reasons in this category were significantly associated with marijuana abstinence at follow-up.

Multivariable associations with marijuana abstinence at follow-up

Results from multivariable logistic regression analyses, which included reasons for marijuana non-use significant at the bivariate level and sociodemographic characteristics and high school risk and protective factors as covariates, are shown in Table 3. Among lifetime abstainers, controlling for the aforementioned covariates, “Concerned about becoming addicted to marijuana” within the Negative Consequences

TABLE 3. Reasons for marijuana non-use at baseline predicting any past-12-month marijuana use at follow-up: Multivariable logistic regression results by lifetime use at baseline

Variable	12-month marijuana use at follow-up			
	Lifetime abstainers		Lifetime users	
	OR	[95% CI]	OR	[95% CI]
Negative consequences				
Concerned about possible psychological damage	0.84	[0.56, 1.26]	0.71	[0.49, 1.02]
Concerned about possible physical damage	0.96	[0.64, 1.45]	0.93	[0.65, 1.33]
My parents would disapprove	1.38	[0.99, 1.92]	0.90	[0.67, 1.21]
It might lead to stronger drugs	1.11	[0.76, 1.61]	0.85	[0.61, 1.18]
Concerned about becoming addicted to marijuana	0.67*	[0.46, 0.97]	0.98	[0.69, 1.39]
Concerned about possible loss of control of myself	0.83	[0.57, 1.21]	0.82	[0.59, 1.12]
My husband/wife (or boyfriend/girlfriend) would disapprove	0.97	[0.68, 1.39]	1.20	[0.89, 1.61]
I might have a bad trip	1.49	[0.99, 2.21]	0.99	[0.67, 1.46]
Lack of interest/impractical				
Don't feel like getting high	0.94	[0.70, 1.26]	0.83	[0.63, 1.11]
Not enjoyable, I didn't like it	1.36	[0.94, 1.97]	0.58***	[0.44, 0.78]
Personal beliefs/peer influences				
It's against my beliefs	0.55***	[0.41, 0.74]	0.90	[0.65, 1.24]
I don't like being with the people who use it	0.54***	[0.38, 0.75]	0.81	[0.57, 1.15]
My friends don't use it	0.55**	[0.39, 0.79]	1.00	[0.70, 1.43]
Sociodemographic characteristics				
Male	0.95	[0.71, 1.25]	0.83	[0.63, 1.09]
High parent education	1.12	[0.81, 1.53]	1.37*	[0.02, 1.85]
Black	0.56*	[0.33, 0.94]	1.03	[0.65, 1.65]
Hispanic	0.65	[0.38, 1.12]	2.16**	[1.33, 3.52]
Asian	0.65	[0.33, 1.29]	1.22	[0.45, 3.31]
Other race/ethnicity	0.47	[0.19, 1.15]	1.71	[0.90, 3.27]
1992–1997 cohort	0.98	[0.69, 1.41]	0.60*	[0.40, 0.90]
1998–2006 cohort	0.64*	[0.44, 0.94]	0.45***	[0.31, 0.65]
2007–2012 cohort	0.68	[0.43, 1.06]	0.47**	[0.30, 0.74]
High school risk and protective factors				
4-year college plans	1.68**	[1.23, 2.30]	1.46*	[1.08, 1.97]
B- or higher	0.97	[0.64, 1.45]	1.14	[0.82, 1.58]
Cut class	1.77**	[1.29, 2.43]	1.44*	[1.08, 1.91]
Evenings out	1.12	[0.85, 1.48]	0.91	[0.70, 1.20]

Notes: Weighted sample size of lifetime abstainers $n = 2,126$, $R^2 = .12$. Weighted sample size of lifetime users, $n = 918$, $R^2 = .13$. Modal age at baseline was 18 years. Modal age at follow-up was 19 years. White = reference group for race/ethnicity. 1977–1991 = reference group for cohort. OR = odds ratio; CI = confidence interval.

* $p < .05$; ** $p < .01$; *** $p < .001$.

category and all reasons for marijuana non-use in the Personal Beliefs/Peer Influences category were significantly associated with lower likelihoods of marijuana use at follow-up. Among lifetime users, only “Not enjoyable, I didn’t like it” was significantly associated with a lower likelihood of any marijuana use at follow-up. Regarding sociodemographic characteristics, lifetime abstainers who identified as Black and were in the 1998–2006 cohort (compared to 1977–1991 cohort) were less likely to use marijuana at follow-up. Lifetime users with high parental education, who identified as Hispanic, and were in the 1977–1991 cohort (compared to all other cohorts) were more likely to use marijuana use at follow-up. High school factors of 4-year college plans and cutting class were associated with a greater likelihood of marijuana use at follow-up among both lifetime abstainers and users. Findings from post hoc sensitivity analyses where models were run without highly correlated reasons for

marijuana non-use (greater or equal to $r = .70$; Supplemental Table B) are provided in the Supplemental Appendix; these findings suggest that our main findings are accurate and likely somewhat conservative with respect to some of the highly correlated reasons.

Discussion

The present study examined reasons why high school seniors, both with and without prior experiences using marijuana, intended not to use marijuana during the next 12 months. In accordance with the cognitive framework that beliefs have a direct impact on behaviors, these reasons were then tested as predictors of marijuana use reported 1 year later. Results from the present study extend existing research, which has focused predominantly on identifying different categories of reasons for marijuana non-use (e.g., Dash &

Anderson, 2015; Fountain et al., 1999; Terry-McElrath et al., 2008) and how the total number of endorsed reasons may be related to later marijuana use (Anderson et al., 2015). Thus, the present study fills a gap in the literature by directly assessing the predictive utility of adolescents' specific reasons for marijuana non-use in relation to actual use behaviors.

One key finding from the present study was that among high school seniors who never used marijuana, reasons related to personal beliefs and peer influences appeared to be driving sustained marijuana abstinence through the year following their senior year of high school. Personal beliefs and peer influence reasons were also related to marijuana abstinence among the lifetime users group, but these associations were only found in bivariate analyses. Although the reason for intending not to use marijuana pertaining to beliefs on the MTF survey did not differentiate between religious and nonreligious personal beliefs, existing research has shown a strong connection between religiosity and lower rates of marijuana use among adolescents (e.g., Nguyen & Newhill, 2016). In any event, personal beliefs may not be a viable target for intervention efforts. Instead, peer influence reasons may be a more realistic and malleable target to reduce marijuana use among youth.

Another key finding was that, among high school seniors who were lifetime abstainers, concern about becoming addicted showed a significant association with marijuana abstinence through the next 12 months. Although perceptions of harm from marijuana use have been decreasing over time for adolescents and young adults (Miech et al., 2017a; Schulenberg et al., 2017), results from the present study indicate that youth who have never used marijuana may continue to abstain because of concerns about becoming addicted. Indeed, marijuana has an addictive potential, with approximately 30% of users reporting symptoms of marijuana use disorder (Hasin et al., 2015). Furthermore, long-term marijuana use has been found to affect reward responsivity in the brain (Martz et al., 2016), and withdrawal symptoms (e.g., sleep problems, irritability, cravings) have been documented (e.g., Gorelick et al., 2012). In the present study, the relation between concerns of addiction and later marijuana use was also significant among lifetime users, but only in the bivariate model. Identifying potential consequences of marijuana use, such as its addictive potential, may be a useful target for prevention and intervention efforts.

Among lifetime users, the only reason significantly associated with abstinence at follow-up was not enjoying marijuana use. This finding reflects the power of experiencing marijuana's negative effects as a motivation for cessation. Further supporting the role of negative effects in relation to discontinuing marijuana use, the bivariate results and results from sensitivity analyses showed associations between concerns about psychological damage and a lower likelihood of using marijuana at follow-up. Although the present study was unable to uncover exactly why respondents did not like

using marijuana, it is possible that a negative event (e.g., paranoia, panic attack) motivated them to discontinue use.

Regarding the association between 4-year college plans and marijuana use, social norms during college tend to promote experimentation and use of drugs and alcohol (e.g., Schulenberg & Maggs, 2002; White & Rabiner, 2012). The year following senior year of high school is a "launching period" rife with individual and contextual level changes, corresponding to changes in marijuana and other substance use (Schulenberg et al., 2016). Indeed, findings from MTF show that one in five students became first-time marijuana users in college in 2016 (Schulenberg et al., 2017), and college has become an increasingly strong risk factor for marijuana initiation since 2014 (Miech et al., 2017b). Thus, the college context may have diminished the strength of high school seniors' reasons for intending not to use marijuana on later marijuana abstinence. Because the present study focused on baseline predictors of marijuana use at follow-up, additional work is needed to test specific aspects of youths' social environments within the year following senior year of high school that may contribute to marijuana use despite prior intentions to abstain.

Strengths and limitations

An important strength of the present study was its use of large U.S. national multi-cohort samples to provide a strong basis for generalization of the findings. In addition, the 1-year prospective longitudinal study design allowed for testing if reasons for marijuana non-use predicted future marijuana use, which has been absent from existing research on this topic. Assessing the long-term impact of adolescents' reasons for marijuana use on marijuana use and problems later in adulthood is valuable to identify indicators of continued risk (e.g., Patrick et al., 2011, 2016). However, looking at associations between reasons for not using marijuana at age 18 and reported marijuana use more proximally—just 1 year later at age 19—is also important from a developmental perspective. The transition out of high school corresponds to many contextual and social changes that heighten risk for substance use, such as leaving the parental home and attending college (e.g., Schulenberg et al., 2016, Staff et al., 2010). Thus, the present study provides valuable information regarding the reasons for marijuana non-use that may be protective against later substance use during a developmental period when risk for substance use is heightened.

In light of these strengths, limitations should be addressed. The sampling frame did not include high school dropouts, and attrition during the 1-year longitudinal period was differential with respect to substance use; these limitations suggest that our findings likely reflect conservative estimates of marijuana use. An additional limitation is that the rank order of reasons for marijuana non-use could not be assessed. Therefore, the relative salience of each reason

is unknown. Furthermore, the MTF survey did not contain questions on reasons for abstaining from other substances. Considering that certain abstinence motives may be unique to marijuana and others are shared across multiple substances (Rosenberg et al., 2012), future research is needed to examine how reasons for non-use may differ by type of substance and the extent to which those reasons contribute to future use.

Conclusions

To our knowledge, the present study is the first to examine how adolescents' reasons for marijuana non-use predicted actual use 1 year later. Findings shed light on the predictive utility of reasons for marijuana non-use during the transition out of high school, a sensitive developmental period in terms of substance use vulnerability. To a certain extent, reasons for marijuana non-use and their associations with future use appear to differ between youth with and without prior experiences using marijuana. This study lays the foundation for additional research on adolescents' reasons to abstain from marijuana, including how such reasons may be used to support efforts to curtail problematic marijuana use.

References

- Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, NJ: Prentice Hall.
- Anderson, K. G., Sitney, M., & White, H. R. (2015). Marijuana motivations across adolescence: Impacts on use and consequences. *Substance Use & Misuse*, 50, 292–301. doi:10.3109/10826084.2014.977396
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, 52, 1–26. doi:10.1146/annurev.psych.52.1.1
- Budd, R., Bleiker, S., & Spencer, C. (1983). Exploring the use and non-use of marijuana as reasoned actions: An application of Fishbein and Ajzen's methodology. *Drug and Alcohol Dependence*, 11, 217–224. doi:10.1016/0376-8716(83)90081-9
- D'Souza, D. C., Perry, E., MacDougall, L., Ammerman, Y., Cooper, T., Wu, Y. T., . . . Krystal, J. H. (2004). The psychotomimetic effects of intravenous delta-9-tetrahydrocannabinol in healthy individuals: Implications for psychosis. *Neuropsychopharmacology*, 29, 1558–1572. doi:10.1038/sj.npp.1300496
- Dash, G. F., & Anderson, K. G. (2015). Marijuana use, motives, and change intentions in adolescents. *Journal of Psychoactive Drugs*, 47, 100–106. doi:10.1080/02791072.2015.1031412
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
- Fountain, J., Bartlett, H., Griffiths, P., Gossop, M., Boys, A., & Strang, J. (1999). Why say no? Reasons given by young people for not using drugs. *Addiction Research & Theory*, 7, 339–353. doi:10.3109/16066359909004391
- Gorelick, D. A., Levin, K. H., Copersino, M. L., Heishman, S. J., Liu, F., Boggs, D. L., & Kelly, D. L. (2012). Diagnostic criteria for cannabis withdrawal syndrome. *Drug and Alcohol Dependence*, 123, 141–147. doi:10.1016/j.drugalcdep.2011.11.007
- Gruber, S. A., Sagar, K. A., Dahlgren, M. K., Racine, M., & Lukas, S. E. (2012). Age of onset of marijuana use and executive function. *Psychology of Addictive Behaviors*, 26, 496–506. doi:10.1037/a0026269
- Gullo, M. J., Matveeva, M., Feeney, G. F. X., Young, R. M. D., & Connor, J. P. (2017). Social cognitive predictors of treatment outcome in cannabis dependence. *Drug and Alcohol Dependence*, 170, 74–81. doi:10.1016/j.drugalcdep.2016.10.030
- Hall, W. (2015). What has research over the past two decades revealed about the adverse health effects of recreational cannabis use? *Addiction*, 110, 19–35. doi:10.1111/add.12703
- Halpern-Felsher, B. (2009). Adolescent decision making: An overview. *Prevention Researcher*, 16, 3–7.
- Hartman, R. L., & Huestis, M. A. (2013). Cannabis effects on driving skills. *Clinical Chemistry*, 59, 478–492. doi:10.1373/clinchem.2012.194381
- Hasin, D. S., Saha, T. D., Kerridge, B. T., Goldstein, R. B., Chou, S. P., Zhang, H., . . . Grant, B. F. (2015). Prevalence of marijuana use disorders in the United States between 2001–2002 and 2012–2013. *JAMA Psychiatry*, 72, 1235–1242. doi:10.1001/jamapsychiatry.2015.1858
- Heitzeg, M. M., Cope, L. M., Martz, M. E., Hardee, J. E., & Zucker, R. A. (2015). Brain activation to negative stimuli mediates a relationship between adolescent marijuana use and later emotional functioning. *Developmental Cognitive Neuroscience*, 16, 71–83. doi:10.1016/j.dcn.2015.09.003
- Jager, J., Schulenberg, J. E., O'Malley, P. M., & Bachman, J. G. (2013). Historical variation in drug use trajectories across the transition to adulthood: The trend toward lower intercepts and steeper, ascending slopes. *Development and Psychopathology*, 25, 527–543. doi:10.1017/S0954579412001228
- Lee, C. M., Neighbors, C., & Woods, B. A. (2007). Marijuana motives: Young adults' reasons for using marijuana. *Addictive Behaviors*, 32, 1384–1394. doi:10.1016/j.addbeh.2006.09.010
- Litt, M. D., Kadden, R. M., Kabela-Cormier, E., & Petry, N. M. (2008). Coping skills training and contingency management treatments for marijuana dependence: Exploring mechanisms of behavior change. *Addiction*, 103, 638–648. doi:10.1111/j.1360-0443.2008.02137.x
- Maggs, J. L., Staff, J., Kloska, D. D., Patrick, M. E., O'Malley, P. M., & Schulenberg, J. (2015). Predicting young adult degree attainment by late adolescent marijuana use. *Journal of Adolescent Health*, 57, 205–211. doi:10.1016/j.jadohealth.2015.04.028
- Martz, M. E., Patrick, M. E., & Schulenberg, J. E. (2015). Alcohol mixed with energy drink use among U.S. 12th-grade students: Prevalence, correlates, and associations with unsafe driving. *Journal of Adolescent Health*, 56, 557–563. doi:10.1016/j.jadohealth.2015.01.019
- Martz, M. E., Trucco, E. M., Cope, L. M., Hardee, J. E., Jester, J. M., Zucker, R. A., & Heitzeg, M. M. (2016). Association of marijuana use with blunted nucleus accumbens response to reward anticipation. *JAMA Psychiatry*, 73, 838–844. doi:10.1001/jamapsychiatry.2016.1161
- McCabe, S. E., Veliz, P., Wilens, T. E., & Schulenberg, J. E. (2017). Adolescents' prescription stimulant use and adult functional outcomes: A national prospective study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 56, 226–233.e4. doi:10.1016/j.jaac.2016.12.008
- Miech, R. A., Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Patrick, M. E. (2017a). *Monitoring the Future national survey results on drug use, 1975–2016: Volume I, Secondary school students*. Ann Arbor, MI: Institute for Social Research, The University of Michigan.
- Miech, R. A., Patrick, M. E., O'Malley, P. M., & Johnston, L. D. (2017b). The influence of college attendance on risk for marijuana initiation in the United States: 1977 to 2015. *American Journal of Public Health*, 107, 996–1002. doi:10.2105/AJPH.2017.303745
- Nguyen, N. N., & Newhill, C. E. (2016). The role of religiosity as a protective factor against marijuana use among African American, White, Asian, and Hispanic adolescents. *Journal of Substance Use*, 21, 547–552. doi:10.3109/14659891.2015.1093558

- Patrick, M. E., Bray, B. C., & Berglund, P. A. (2016). Reasons for marijuana use among young adults and long-term associations with marijuana use and problems. *Journal of Studies on Alcohol and Drugs*, 77, 881–888. doi:10.15288/jsad.2016.77.881
- Patrick, M. E., Schulenberg, J. E., Martz, M. E., Maggs, J. L., O'Malley, P. M., & Johnston, L. D. (2013). Extreme binge drinking among 12th-grade students in the United States: Prevalence and predictors. *JAMA Pediatrics*, 167, 1019–1025. doi:10.1001/jamapediatrics.2013.2392
- Patrick, M. E., Schulenberg, J. E., O'Malley, P. M., Johnston, L. D., & Bachman, J. G. (2011). Adolescents' reported reasons for alcohol and marijuana use as predictors of substance use and problems in adulthood. *Journal of Studies on Alcohol and Drugs*, 72, 106–116. doi:10.15288/jsad.2011.72.106
- Rosenberg, H., Bonar, E. E., Paylick, M., Jones, L. D., Hoffmann, E., Murray, S., . . . Baylen, C. (2012). Associations between university students' reported reasons for abstinence from illicit substances and type of drug. *Journal of College Student Development*, 53, 91–105. doi:10.1353/csd.2012.0010
- Schulenberg, J. E., Johnston, L. D., O'Malley, P. M., Bachman, J. G., Miech, R. A., & Patrick, M. E. (2017). *Monitoring the Future national survey results on drug use, 1975–2016: Volume II, College students and adults ages 19–55*. Ann Arbor, MI: Institute for Social Research, The University of Michigan.
- Schulenberg, J. E., & Maggs, J. L. (2002). A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. *Journal of Studies on Alcohol, Supplement 14*, 54–70. doi:10.15288/jsas.2002.s14.54
- Schulenberg, J. E., Maslowsky, J., Patrick, M. E., & Martz, M. E. (2016). Substance use in the context of adolescent development. In S. Brown & R. A. Zucker (Eds.), *The Oxford handbook of adolescent substance abuse*. New York, NY: Oxford University Press.
- Schulenberg, J. E., Patrick, M. E., Kloska, D. D., Maslowsky, J., Maggs, J. L., & O'Malley, P. M. (2016). Substance use disorder in early midlife: A national prospective study on health and well-being correlates and long-term predictors. *Substance Abuse: Research and Treatment*, 9, Supplement 1, 41–57. doi:10.4137/SART.S31437
- Sewell, R. A., Schnakenberg, A., Elander, J., Radhakrishnan, R., Williams, A., Skosnik, P. D., . . . D'Souza, D. C. (2013). Acute effects of THC on time perception in frequent and infrequent cannabis users. *Psychopharmacology*, 226, 401–413. doi:10.1007/s00213-012-2915-6
- Staff, J., Schulenberg, J. E., Maslowsky, J., Bachman, J. G., O'Malley, P. M., Maggs, J. L., & Johnston, L. D. (2010). Substance use changes and social role transitions: Proximal developmental effects on ongoing trajectories from late adolescence through early adulthood. *Development and Psychopathology*, 22, 917–932. doi:10.1017/S0954579410000544
- Swan, M., Schwartz, S., Berg, B., Walker, D., Stephens, R., & Roffman, R. (2008). The Teen Marijuana Check-Up: An in-school protocol for eliciting voluntary self-assessment of marijuana use. *Journal of Social Work Practice in the Addictions*, 8, 284–302. doi:10.1080/15332560802223305
- Terry-McElrath, Y. M., O'Malley, P. M., & Johnston, L. D. (2008). Saying no to marijuana: Why American youth report quitting or abstaining. *Journal of Studies on Alcohol and Drugs*, 69, 796–805. doi:10.15288/jsad.2008.69.796
- Volkow, N. D., Baler, R. D., Compton, W. M., & Weiss, S. R. B. (2014). Adverse health effects of marijuana use. *The New England Journal of Medicine*, 370, 2219–2227. doi:10.1056/NEJMr1402309
- Volkow, N. D., Swanson, J. M., Evins, A. E., DeLisi, L. E., Meier, M. H., Gonzalez, R., . . . Baler, R. (2016). Effects of cannabis use on human behavior, including cognition, motivation, and psychosis: A review. *JAMA Psychiatry*, 73, 292–297. doi:10.1001/jamapsychiatry.2015.3278
- Weiner, M. D., Sussman, S., McCuller, W. J., & Lichtman, K. (1999). Factors in marijuana cessation among high-risk youth. *Journal of Drug Education*, 29, 337–357. doi:10.2190/PN5U-N5XB-F0VB-R2V1
- White, H. R., & Rabiner, D. (2012). *College drinking and drug use*. New York, NY: Guilford Press.