STUDENT SUBSTANCE USE

FACTORS ASSOCIATED WITH REGULAR MARIJUANA USE AMONG HIGH SCHOOL STUDENTS: A LONG-TERM FOLLOW-UP STUDY

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ABSTRACT

The present study investigated whether several behavioral and psychosocial factors measured during early adolescence predicted regular marijuana use 6 years later in a sample of high school students. As part of a school-based survey, 7th-grade students ($N = 1132$) reported levels of alcohol, tobacco, and marijuana use, and were assessed on several domains of psychosocial functioning potentially relevant in the etiology of marijuana use. When students were followed-up in the 12th-grade, 14% smoked marijuana on a regular basis (once or more per month). Findings indicated that early cigarette smoking, alcohol use, and alcohol intoxication predicted later regular marijuana use. For boys, early marijuana use increased the odds for later regular marijuana use. Cigarette

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smoking by friends and siblings during early adolescence also increased the likelihood of later monthly marijuana use. The findings suggest that early prevention programs for adolescent alcohol, tobacco, and/or other drug use may have important preventive effects in terms of potentially more serious levels of marijuana involvement later in adolescence and early adulthood.

Key Words: Adolescent;   Marijuana;   High   school; Longitudinal

INTRODUCTION

Marijuana and other cannabis-related drugs are the most commonly used illicit drugs in the United States (1). According to the Monitoring the Future Study, half (50%) of 12th graders reported lifetime marijuana use in 1998, up from one in three (33%) in 1992; over this time frame, 30-day prevalence rates for marijuana use among 12th-graders doubled from 12% in 1992 to 23% in 1998 (2). These increases are notable because marijuana use, particularly chronic use, can contribute to a variety of health and behavioral problems. These can include neuropsychiatric and cognitive deficits, as well as higher rates of delinquency, school dropout, and family disruption (3,4). Marijuana is also believed to serve as an important "gateway" to the use of other illicit drugs (5).

Problem Behavior Theory (PBT) (6) represents one of the most comprehensive psychosocial theories to be applied to adolescent marijuana use. This theory proposes that problem behaviors such as marijuana use are influenced by role models who engage in the behavior (e.g., peers), social controls against antisocial behavior (e.g., parental monitoring), along with a variety of individual motivational forces that either provide an impetus to action (e.g., social anxiety) or regulate and inhibit behavior (e.g., behavioral self-control). Research has shown that many of the conceptual domains of PBT are associated with adolescent marijuana use. Donovan (7) found highly significant correlations between PBT domains and marijuana use, with parental approval of drug use, friends' drug use, alcohol intake, and general deviance being the strongest and most consistent predictors of marijuana use. Furthermore, these associations were found to be consistent across datasets collected over a 20-year period of time, suggesting that the PBT framework has enduring explanatory validity. However, some limitations of this research were that most of the analyses were cross-sectional and the longitudinal analyses were of relatively short duration. In addition,

marijuana use was examined primarily as a continuous variable, so prediction of frequent marijuana involvement was not specifically examined. The goal of the present study was to examine determinants of regular marijuana use (as defined by monthly use or greater) among high school seniors by examining several posited risk and protective factors that map conceptually with the domains of PBT, measured when students were in the 7th-grade.

METHOD

Sample

Data for the present study were collected as part of a school-based drug prevention trial for adolescents (8). In the present analysis, only the control-group participants who did not receive the intervention were examined in order to study the natural developmental course of marijuana use during adolescence. Participating students ($N = 1132$) were 90% White and had a median age of 18.1 years at follow-up. The longitudinal sample was 54% boys ($N = 608$) and 46% girls ($N = 524$). Most participants came from two-parent homes (86%) that were located in middle-class suburban and rural areas of New York State. The attrition rate over the 6-year period was approximately 40%, primarily due to school absenteeism, transfers, and dropouts. Attrition analyses revealed that participants included in the present analyses were more conventional and less likely to engage in substance use at baseline compared to the youth who ultimately dropped out of the study.

Procedure

Three forms of the baseline survey questionnaire were distributed in 1985, each containing a core set of common items and a smaller set of unique items.[1] In the 7th-grade, data were collected in all regular classrooms of the participating schools during a single class period. Research staff administered the surveys rather than school personnel, and students were assured that their responses would be confidential. The 12th-grade follow-up questionnaire was distributed in 1991, had one form, and was shorter than the 7th-grade survey.

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[1]Values of N for each predictor variable differed because (1) the survey was a three-form design with planned missingness and (2) there was missing data primarily due to fatigue (i.e., failure of some students to complete the survey).

Measures

Substance Use

The 7th-grade baseline survey assessed several variables related to participants' substance use behavior and attitudes. To assess marijuana use, respondents were asked "*How often (if ever) do you usually smoke marijuana?*" with response options ranging from 1 (*never tried it*) to 9 (*more than once a day*). Alcohol use and drunkenness frequency were assessed using the same 9-point response scale. To assess cigarette smoking, respondents were asked, "*Have you ever smoked a cigarette or even part of a cigarette?*" with response options from 1 (*no, not even a few puffs*) to 5 (*I smoke cigarettes*). Students' attitudes about marijuana were assessed by asking them to what extent they agree with 10 statements ($\alpha = .85$), such as "*Smoking marijuana makes you look cool.*" In the 12th-grade, one item was used to assess the frequency of marijuana use and a dichotomous score was created with youth being considered regular marijuana users if they smoked marijuana on a monthly basis or more frequently.

Social Influences

The baseline survey also assessed several variables related to the substance use behaviors of friends and family members. Participants indicated the proportion of friends who drank alcohol, smoked cigarettes, or used marijuana on a scale from 1 (*none*) to 5 (*all or nearly all*). Participants also indicated the number of siblings and parents who smoke cigarettes.

Individual Characteristics and Skills

Additional measures assessed at baseline included social anxiety, behavioral self-control, and relaxation skills. Social anxiety was assessed using eight items ($\alpha = .77$) from a measure by Fleming and Watts (9). Behavioral self-control was assessed using 10 items ($\alpha = .80$) from the Self-Control Rating Scale (10). Relaxation skills were measured using five items ($\alpha = .64$) that assess the use of skills to control anxiety or nervousness, such as "*When I feel anxious, I imagine myself in a quiet, peaceful place.*"

Data Analysis

To examine how 7th-grade substance use, social influences, and individual psychosocial factors predicted later marijuana use among high school seniors, a series of logistic regression analyses were conducted. To create appropriate reference categories in the predictor variables, response options for some variables were collapsed. Adolescent males typically report higher rates of marijuana use than females (11), and models in the present study were examined separately by gender. The proportion of variance explained by each predictor variable was examined using Nagelkerke's (12) coefficient of determination, an analogue of the R^2 statistic for logistic regression.

RESULTS

Almost half (44%) of 12th-graders in this study reported having tried marijuana at some point in their lifetime, 21% reported using marijuana more than once, 14% reported smoking marijuana once a month or more, and 6% reported weekly use. Boys were more likely to have smoked marijuana on a monthly basis relative to girls (17% vs. 10%; $\chi^2 = 10.4$, $p < .001$).

Predictors of Marijuana Use

Substance Use Behaviors

Logistic regression analyses revealed that early use of cigarettes and alcohol each independently predicted later regular marijuana use for boys and for girls. As shown in Table 1, adolescents who had smoked "a few cigarettes" or more as 7th-graders were over three times as likely to be marijuana users as high school seniors compared to students who had never smoked cigarettes. In fact, girls who reported having tried "only a few puffs" of a cigarette were 2.25 times as likely to be regular marijuana users later in adolescence, compared to girls who had never smoked cigarettes. Similar findings were observed for early-stage alcohol use. Boys who reported that they had used alcohol more than a few times in the 7th-grade were 2.36 times as likely to be regular marijuana users as seniors compared to boys who never used alcohol in the 7th-grade; correspondingly, girls were 2.48 times as likely to be regular marijuana users compared to girls who had never used alcohol. "Experimental" alcohol use (i.e., students had tried

Table 1. Results of Logistic Regression Analyses Predicting Regular Marijuana Use in the 12th-Grade

Variable Measured in 7th-Grade:	Boys					Girls				
	N	B	SE	OR (95% CI)	R^2	N	B	SE	OR (95% CI)	R^2
Cigarette smoking					.043					.043
Never smoked	392			1.00		373			1.00	
Have tried a few puffs	129	0.47+	.27	1.61 (0.95, 2.72)		97	0.81*	.34	2.25 (1.15, 4.41)	
≥a few cigarettes	86	1.19***	.28	3.06 (1.78, 5.26)		53	1.17**	.39	3.27 (1.50, 6.95)	
Alcohol use					.026					.033
Never used alcohol	235			1.00		268			1.00	
Have tried alcohol	226	0.43	.27	1.54 (0.91, 2.60)		183	0.83**	.32	2.30 (1.22, 4.33)	
Use alcohol regularly	136	0.86**	.28	2.36 (1.36, 4.13)		66	0.91**	.42	2.48 (1.09, 5.66)	
Alcohol intoxication					.042					.015
Never used alcohol	403			1.00		425			1.00	
Never been drunk	173	0.60*	.24	1.82 (1.15, 2.88)		86	0.21	.37	1.23 (0.59, 2.57)	
Been drunk before	27	1.49***	.42	4.44 (1.96, 10.08)		9	1.54**	.73	4.68 (1.13, 19.43)	
Marijuana use					.019					.010
Never used	576			1.00		509			1.00	
Have tried or use regularly	30	1.14**	.40	3.05 (1.40, 6.61)		12	−5.07	10.6	0.01 (0.00, >100)	
Sibling cigarette smoking					.062					.054
None smoked	200			1.00		176			1.00	
One smoked	46	0.76+	.42	2.14 (0.94, 4.87)		46	0.89*	.44	2.44 (1.04, 5.73)	
Two or more smoked	18	1.59**	.53	4.90 (1.73, 13.89)		31	−1.23	1.05	0.29 (0.04, 2.28)	

Variable	n	B	SE	OR (95% CI)	p	n	B	SE	OR (95% CI)	p
Friends' cigarette smoking					.047					.028
None smoked	210			1.00		239			1.00	
Less than half	138	0.06	.31	1.06 (0.57, 1.96)		81	0.54	.38	1.72 (0.81, 3.65)	
Half or more	49	1.20***	.36	3.32 (1.64, 6.72)		48	0.95*	.42	2.60 (1.14, 5.91)	
Antimarijuana attitudes					.003					.129
Low	75			1.00		46			1.00	
Medium	65	−0.23	.45	0.79 (0.33, 1.93)		51	−1.48+	.83	0.23 (0.05, 1.16)	
High	62	0.05	.44	1.05 (0.44, 2.46)		56	−2.29*	1.09	0.10 (0.01, 0.86)	
Relaxation skills					.008					.046
Low	148			1.00		174			1.00	
Medium	102	−0.42	.37	0.66 (0.32, 1.34)		84	0.09	.40	1.10 (0.50, 2.40)	
High	164	0.04	.29	1.05 (0.59, 1.85)		130	−1.23*	.51	0.29 (0.11, 0.80)	
Behavioral self-control skills					.010					.042
Low	131			1.00		94			1.00	
Medium	129	−0.35	.33	0.71 (0.37, 1.34)		117	−1.03*	.46	0.36 (0.15, 0.88)	
High	103	−0.50	.36	0.61 (0.30, 1.23)		103	−0.89+	.46	0.41 (0.17, 1.01)	
Social anxiety					.041					.003
Low	64			1.00		91			1.00	
Medium	72	1.02*	.51	2.76 (1.01, 7.56)		62	0.05	.61	1.05 (0.32, 3.48)	
High	97	0.21	.54	1.24 (0.43, 3.53)		79	0.30	.54	1.35 (0.47, 3.91)	

Note: **B**, unstandardized regression coefficient; SE, standard error; OR, odds ratio; CI, confidence interval.
+$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

alcohol) was associated with increased risk for later regular marijuana use (OR = 2.3) in girls. Furthermore, those 7th-graders who reported that they had been intoxicated from drinking at least once were significantly more likely to be regular marijuana users in the 12th-grade: boys were 4.44 times more likely, and girls were 4.68 times more likely. Finally, boys who reported that they had used marijuana more than a few times in the 7th-grade were 7.89 times as likely to be regular marijuana users as seniors compared to boys who never used marijuana in the 7th-grade. In fact, early marijuana use was by far the strongest predictor of later marijuana use for boys, although it was not significant for girls (perhaps due to low base rates of marijuana use among 7th-grade girls). Compared to alcohol and marijuana use, cigarette smoking explained the largest proportion of variance in later marijuana use (4.3% for boys and for girls).

Social Influences

As shown in Table 1, logistic regression analyses indicated that the smoking-related behavior of friends and siblings in 7th-grade predicted later regular marijuana use for boys and for girls. Boys who reported that half or more of their friends smoked cigarettes were 3.32 times as likely to be subsequent monthly marijuana users compared to boys who reported that none of their friends smoked. Correspondingly, girls who reported that half or more of their friends smoked cigarettes were 2.6 times as likely to be regular marijuana users as high school seniors compared to girls whose friends had never smoked cigarettes. Smoking by siblings was related to later marijuana use for boys and for girls; those reporting that one sibling smoked cigarettes in the 7th-grade were over twice as likely to become regular marijuana users compared to students who reported that none of their siblings smoked. For boys, having had two or more siblings who smoked cigarettes raised the odds ratio for later regular marijuana use to 4.9. In fact, sibling cigarette smoking was the second strongest predictor for boys' later regular marijuana use (after early marijuana use). Sibling cigarette smoking explained 6.2% of variance in later monthly marijuana use in boys and 5.4% of girls' use.

Individual Characteristics and Skills

Analyses were conducted to determine if social anxiety and skills related to behavioral self-control and relaxation were associated with later regular marijuana use. Findings indicated that girls who reported moderate

or high self-control skills were less likely to become regular marijuana users (OR = 0.36, 0.41, respectively) compared to girls who reported low self-control. In addition, girls who reported high relaxation skills were less likely to become regular marijuana users (OR = 0.29) compared to girls who reported low relaxation skills. Conversely, social anxiety was a risk factor for later regular marijuana use for boys, but not for girls. Boys with medium levels of social anxiety were 2.76 times as likely to be later regular marijuana users compared to those with low social anxiety.

DISCUSSION

This 6-year follow-up study examined whether posited risk and protective factors assessed during early adolescence were associated with later monthly marijuana use at the end of high school. Findings indicated that 14% of students were regular marijuana users (i.e., monthly or more) at the end of high school. Early experiences with the gateway substances of cigarettes and alcohol significantly increased the likelihood of becoming a regular marijuana user later in adolescence. While most of these effects were observed for both genders, some differences were found between boys and girls. For example, early marijuana use among boys predicted later regular use, but early use among girls did not, perhaps because of low base rates of marijuana use among 7th-grade girls. On the other hand, "experimental" drinking or smoking (e.g., having tried "only a few puffs" on a cigarette) were significant risk factors for later regular marijuana use among girls. Furthermore, having been drunk before was the single strongest predictor of later regular marijuana use in girls. Thus, independent of gender, early experimentation with substances increased the odds of becoming a regular marijuana user in this study.

Findings also revealed that many of the social influence factors that increased the odds of later regular marijuana use were related to others' use of cigarettes or alcohol. For example, having had a majority of friends or a sibling who smoked cigarettes significantly predicted later regular marijuana use. These findings support the vast literature on the importance of peer and social influences on adolescent drug use, and suggest that many of the etiological factors for substance use among youth are interrelated. This general pattern of results supports the notion that problem behaviors have similar causes and tend to cluster together throughout adolescence (6).

Several additional variables significantly increased the odds for regular marijuana use for boys or girls. For example, antimarijuana attitudes were associated with less later regular marijuana use in girls. Another gender difference was that high behavioral self-control skills, as measured in early

adolescence, predicted less later regular marijuana use among girls but not boys. These findings suggest that the ability to manage impulsive or disruptive behavior during early adolescence is an important "protective" characteristic for girls throughout adolescence. However, future research is needed to replicate the gender differences found in the present study and to better understand these relationships for different levels of marijuana use. Further research is also needed to determine to what extent these attitudes and skills can be taught or reinforced among youth.

The findings from the present study have several implications for drug-use prevention programs, particularly those that emphasize skills-training and competence enhancement strategies as an effective means of reducing adolescent drug use. One implication is that early intervention programs that address the social and psychological determinants of substance use may have important preventive effects, not only in terms of smoking and drinking, but also in terms of later regular marijuana use. Public health efforts that reduce, delay, or prevent early experimentation with alcohol or tobacco may significantly reduce regular marijuana use in later adolescence and adulthood. There are several limitations of this research that should be noted. First, the significant relationships among the variables measured may partly reflect shared method variance since all data was obtained by self-report questionnaire. Furthermore, the present study did not look at interactions between predictors, and therefore the effects of some risk factors may be more complex than our study was able to identify. Additional limitations include the fact that the sample was predominantly White and middle-class, and therefore the findings may not be generalizable to regular marijuana use among other ethnic groups. Although the sample was conventional in behavior and not representative of high-risk adolescents, a substantial proportion of the participants initiated marijuana use over the course of the study. Future research should investigate the differential prediction of experimental vs. regular marijuana use by gender and also by ethnicity. It will also be important to examine more comprehensively the relative importance of various actual and potential risk factors, how interactions among predictors explain regular marijuana use, and how posited risk factors for frequent marijuana use differ from those of experimentation among youth.

ACKNOWLEDGMENTS

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RESUMEN

El presente estudio investigo si varios factores de conducta y psicosociales medidos en la temprana adolescencia predecía el uso de marihuana 6 años más tarde en una muestra de estudiantes en la escuela secundaria. Como parte del estudio basado en la escuela, un grupo de

estudiantes del séptimo grado ($N = 1132$) reportaron niveles de alcohol, tabaco, y uso de marihuana y fueron evaluados en varios dominios de funcionamiento psicosociales relevante potencialmente en la etiología del uso de marihuana. Cuando los estudiantes fueron seguidos hasta el doce-avo (12) grado, 14% fumaban marihuana regularmente (una o mas veces por mes). Los resultados han indicado que el comienzo de fumar cigarrillos, beber alcohol, y la intoxicación de alcohol predicó el uso regular de marihuana más adelante. La influencia de los amigos y parientes que fuman cigarrillos en la vida de un adolescente en temprana edad también aumenta la probabilidad al uso de marihuana mensualmente más adelante. Los resultados sugieren que los programas tempranos de prevención para prevenir el uso de alcohol, tabaco, y/u otras drogas en los adolescentes pueden tener efectos preventivos importantes en términos de uso más serios de marihuana más adelante en la adolescencia y en la temprana edad adulta.

RÉSUMÉ

L'étude présente a enquêté sur si plusieurs facteurs behavioristes et psychosociaux ont mesuré pendant adolescence tôt a prédit l'usage de la marijuana régulier 6 années plus tard dans un échantillon de lycéens. Comme partie d'une étude scolaire basée, 7e étudiants du niveau ($N = 1132$) a rapporté des niveaux d'alcool, tabac, et usage de la mari-juana et a été réparti sur plusieurs domaines de psychosocial fonction-nant potentiellement pertinent dans l'etiology d'usage de la marijuana. Quand les étudiants ont été suivis dans le 12e nivequ, 14% ont fumé de la marijuana sur une base régulière (une fois ou plus par mois). Les conclusions ont indiqué que les cigarette fumer tôt, usage de l'alcool, et ivresse de l'alcool a prédit l'usage de la marijuana régulier plus tardif. Pour les garçons, l'usage de la marijuana tôt a augmenté les chances pour usage de la marijuana régulier plus tardif. La cigarette qui fume aussi par les amis et les frères et soeurs pendant adoloescence tôt a augmenté la probabilité d'usage de la marijuana mensuel plus tardif. Les conclusions suggèrent que la prévention tôt programme pour alcool adolescent, tabac, et/ou l'autre usage de la drogue peut avoir plus tard des effets préventifs importants quant à niveaux potentiellement plus sérieux de participation de la marijuana dans adolescence et âge adulte tôt.

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