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The social norms of birth cohorts and adolescent marijuana use in the United States, 1976-2007

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Abstract:

Aims: Studies of the relationship between social norms and marijuana use have generally focused on individual attitudes, leaving the influence of larger societal-level attitudes unknown. The present study investigated societal-level disapproval of marijuana use defined by birth cohort or by time period.

Design: Combined analysis of nationally-representative annual surveys of secondary school students in the U.S. conducted 1976-2007 as part of the Monitoring the Future study.

Setting: In-school surveys completed by adolescents in the U.S.

Participants: 986,003 adolescents in grades 8, 10, and 12

Measurements: Main predictors included the percentage of students who disapproved of marijuana in each birth cohort and time period. Multi-level models with individuals clustered in time periods of observation and birth cohorts were modeled, with past-year marijuana use as the outcome.

Findings: Results indicated a significant and strong effect of birth cohort disapproval of marijuana use in predicting individual risk of marijuana use, after controlling for individual-level disapproval, perceived norms towards marijuana, and other characteristics. Compared to birth cohorts in which most (87-90.9%) adolescents disapproved of marijuana use, odds of marijuana use were 3.53 times higher in cohorts where less than half (42-46.9%) disapproved (99% C.I. 2.75, 4.53).

Conclusions: Individuals in birth cohorts that are more disapproving of marijuana use are less likely to use, independent of their personal attitudes towards marijuana use. Social norms and attitudes regarding marijuana use cluster in birth cohorts, and this clustering has a direct effect on marijuana use even after controlling for individual attitudes and perceptions of norms.

Introduction

Marijuana is the most commonly used illicit substance in the United States (US) and worldwide (1-4). First use most often occurs during adolescence (2, 5-8), and prospective studies indicate that heavy marijuana use in adolescence is associated with clinically serious short- and long-term outcomes (6, 8-12). To reduce these adverse outcomes, primary prevention of adolescent marijuana initiation is central, requiring a clearer understanding of the causes of early marijuana use.

Adolescent marijuana use is most commonly explained at the individual level. Well-documented risk factors include parental history of drug use (13), parental monitoring (14-16), home environment (14, 17, 18), peer influence (19, 20), school difficulties (21, 22), personality traits, e.g., impulsivity (23), behavioral disinhibition (24, 25), and other indicators of externalizing behavior (26, 27). These and other individual factors explain a meaningful proportion of individual differences in marijuana use. However, recognition is growing that broad population-level factors such as those associated with schools, neighborhoods, and historical time periods, are also required in the etiologic model to provide a more complete explanation (28-30).

The necessity of such population-level factors becomes clear when considering the substantial changes over time in adolescent marijuana use, as the distributions of individual-level factors have not changed substantially enough to explain broad changes in the prevalence of marijuana use observed in the U.S. (31-33). Epidemiologic estimates in the U.S. indicate that adolescent marijuana use peaked in the late 1970s, decreased substantially in the 1980s, increased in the 1990s, and has declined some since then (2). One mechanism potentially underlying increases or decreases in marijuana use prevalence is change in social norms regarding use, e.g., attitudes such as disapproval. At the individual level, disapproval of marijuana use and perceptions of social norms regarding use appear to play a strong role in explaining substance use (31, 34-37). However, the effects of norms at the group or population level on substance use have seldom been studied.

While correlated with individual-level norms, population-level norms are a separate construct, important both methodologically and substantively. Methodologically, individual reports of perceptions

may be influenced by biased appraisal processes (e.g., adolescent substance users may report that the community has more permissive norms than adolescents in the same community who do not use substances (38-42)). Substantively, the broader social context in which youth are embedded may influence behaviors such as marijuana use in addition to individual-level youth attitudes. Analogous with this idea, multi-level studies of adult drinking indicate that group-level social norms, with groups defined by place, e.g., at the neighborhood- and workplace-level, predict individual alcohol consumption, even after controlling for individual risk factors (43, 44).

At the population level, disapproval of marijuana use can be characterized by time period and by birth cohort. Available evidence indicates that birth cohorts whose adolescence or early adulthood occurred in the late 1960's and 1970's have higher incidence or prevalence of marijuana use than other cohorts (45-48), suggesting that marijuana use aggregates by birth cohorts. Using information from the Monitoring the Future (MTF), Johnston et al. (4) interpreted the staggered nature of inflection points across sequential age bands in perceived risk and disapproval as indicative of lasting cohort effects in both of these attitudes and beliefs, which they posit as having led to cohort effects in the use of a number of drugs. However, other evidence indicates that marijuana decreased across all ages in the 1990s, suggesting that marijuana use also aggregates by time period (47, 48). While these studies have been important in characterizing the overall trends in marijuana use across time, little empirical research has been conducted to study the mechanisms through which changes over time occur. In sum, while much is known about the individual-level relationship between norms and marijuana use, the population-level effects across time periods and birth cohorts provide unique and much-needed information. For example, to the extent that cohort-specific norms mediate time trends in marijuana use, population-level prevention and intervention efforts should focus on understanding the behavior of cohorts of young people rather than specific policies and laws that affect everyone in the population simultaneously.

The present study utilizes the conceptual framework of multi-level models in which individuals are clustered in birth cohorts and time periods to characterize the association between population-level norms and individual-level marijuana use. We use nationally-representative data on adolescents from

1976-2007 in the Monitoring the Future project (2). We address two aims, one focused on birth cohorts and the other on time periods. First, we test whether individuals in birth cohorts with a high population-level disapproval of marijuana use during adolescence are less likely to report using marijuana in the 12 months prior to the survey, controlling for individual-level disapproval, perceptions of friends' use, demographics and period-specific disapproval. Second, we perform a similar test to determine whether living in a particular period with a high population-level disapproval of marijuana use reduces the risk for past 12-month marijuana use, controlling for individual-level disapproval, perceptions of friends' use, demographics and cohort-specific disapproval.

Methods

Study design and collection of data

The Monitoring the Future (MTF) project conducts an annual cross-sectional survey of 12th grade students in approximately 130 U.S. public and private high schools conducted during spring. High schools are selected under a multi-stage random sampling design with replacement. Schools are invited to participate for two years. Schools that decline participation are replaced with schools that are similar on geographic location, size, and urbanicity. The overall participation rates (including replacements) range from 95% to 99% for all study years. Starting in 1975, approximately 15,000 12th graders were sampled annually. Student response rates ranged from 77% (1976) to 91% (1996, 2001, 2006). Almost all non-response is due to absenteeism; less than 1% of students refuse to participate.

In 1991, 8th and 10th graders were added, with approximately 17,000 8th-grade students (in about 150 schools) and 15,000 10th-grade students (in about 125 schools) sampled annually. Self-administered questionnaires were given to students, typically in classroom settings with a teacher present. Teachers were instructed to avoid close proximity to the students during administration to ensure students could respond confidentially. Detailed description of design and procedures are provided elsewhere (2).

Included in the present study were all individuals for which birth year was available. A total of three birth years are available for 12th graders from 1976-1990, and nine birth years for 8th, 10th, and 12th graders from 1991-2007 (three birth years for each grade). Individuals who were 17 years old in 1976 (N=8,627) are of the same birth cohort (1959) as individuals who were 18 in 1977 (N=7,401) and 19 in 1978 (N=643). Thus, the 1959 birth cohort comprises 16,671 individuals. Similarly, individuals who were 13 in 2005 (N=6,820) are of the same birth cohort (1992) as individuals who were 14 in 2006 (N=11,083) and 15 in 2007 (N=7,893). Thus, the 1992 birth cohort comprises 25,796 individuals. The smallest birth cohorts are the oldest and youngest (1957, N=630; 1994, N=6,451), and the largest birth cohort is 1980 (N=49,227). In total, the present analysis includes 986,003 adolescents.

Measures

The MTF questionnaire covers drug use and related attitudes. Importantly, the measures analyzed in the present study were included at each wave of data collection. All questionnaires have a core set of items including assessment of marijuana use. Respondents are randomized to one of two to six (depending on grade and year) questionnaire forms in which different sets of questions are included. Items relevant to the present study were asked in a minimum of one questionnaire form and a mode of two questionnaire forms.

Outcome. The outcome variable in the present analysis was a dichotomous indicator of past-year use of any cannabis (including marijuana and hashish). Given the low prevalence of hashish use compared to marijuana use in the U.S. (49), we use the term ‘marijuana’ throughout this manuscript.

Predictors. Participants are queried about whether they disapproved of individuals "smoking marijuana occasionally". Response options included ‘don’t disapprove’, ‘disapprove’, and ‘strongly disapprove’. Participants are also asked to estimate how many of their friends smoke marijuana (response options: none, a few, some, most, all), and how difficult it would be for them to get marijuana (response options:

probably impossible, very difficult, fairly difficult, fairly easy and very easy). We included all three of these marijuana variables (disapproval, how many friends smoke, how difficult to get) as individual-level control variables. Previously identified demographic risk factors for marijuana use at the individual level were also included in regression models: sex, age (entered as a continuous variable), race/ethnicity, and highest level of respondent-identified parental education.

At the population level, two aggregate measures of disapproval were created, one to assess norms by time period (year) and one to assess norms by birth cohort. We first dichotomized the measure assessing disapproval of marijuana use (strongly disapprove and disapprove versus don't disapprove). We then created variables indicating the proportion of students who disapproved of marijuana use in each year (range 42.6% in 1978 to 85.9% in 1992), and the proportion of students who disapproved of marijuana use in each birth cohort (range 44.0% in 1959 to 87.6% in 1993).

Statistical analysis

To prepare for the multi-level analyses, we created the population-level measures of disapproval described above using an approximate 1% (N=9,860) random subset of the total sample, selected using PROC SQL in SAS 9.2. These individuals were excluded from all subsequent analyses to mitigate same-source bias, a bias that can arise in multi-level studies when group-level variables are derived by aggregating the same individual-level data (50-53). The remaining 976,143 respondents provide data for the multi-level analyses. Population-level estimates of approval from the random sub-sample and the remaining sample differed only slightly, with a mean of 0.2% (range 0.01% [12-graders in 1994] to 0.4% [individuals in the 1957 birth cohort]), indicating that the random subsample provided valid estimates of the underlying larger sample. We replicated the analyses using estimates derived from the entire sample rather than a subset, and included outcome information from the entire sample; results did not change across the two methods. We present the analysis using the split sample, however, as it is a more rigorous method to use aggregated data within a sample for prediction of an outcome within the same sample.

Our principal analytic approach was to use multi-level models that included the period and cohort mechanistic variables, group-level disapproval. In these models, individuals were simultaneously

clustered by time period and birth cohort as suggested by Yang and others for age-period-cohort modeling (54-56). Two group-level disapproval variables were considered: one representing the disapproval for each birth cohort, and one representing the disapproval for each time period. First, we analyzed population-level disapproval as a continuous variable, and transformed estimates to indicate the change in odds based on a 5-percentage point change in disapproval. Preliminary analyses suggested that population-level disapproval had a linear relation with log odds of marijuana use. Second, we used categorical dummy variables for each 5-percentage point increase in population-level disapproval in order to detect any non-log-linear effects. We first estimated models adjusted for age at the individual level only, and then included individual-level covariates including personal disapproval, perceived norms, friend's use, and socio-demographics. All analyses were conducted using MPLUS version 5.2 (57) with full integration maximum-likelihood estimation methods for missing data.

Sample weighting

All estimates are weighted to account for variations in school selection probability as well as between-school sample size. We account for clustering by geographic area and school by raising the critical alpha for null hypothesis rejection to $p<0.01$, as has been done previously in time trend analyses of the Monitoring the Future datasets (31, 58-61). There is no well-accepted method to combine adjustments for within-year clustered sampling in panel datasets combined across time, especially in a multi-level framework where the outcome is measured at the individual level. Failing to properly account for this clustering may underestimate standard errors at the individual level, so we interpret the statistical significance of coefficients estimated at the individual level with caution. However, this would not bias estimates from the period and cohort levels, which were the main focus of the present study.

Results

Trends over time

Figure 1 displays the trend over time in past-year marijuana use, as well as disapproval by age, period, and cohort. For period and cohort trends, we restrict presentation to the 12^{th} grade only, as 8^{th} and

10th grades were included from 1991 forward only. Trends are similar for 8th and 10th grades, although in these grades, the prevalence of marijuana use is lower and disapproval higher. For the youngest age group (age 13), past-year marijuana use was lowest (10.1%) and disapproval highest (87.9%) compared with all other ages. By period, use was highest in 1978 (51.8%) and disapproval lowest in 1977 (43.0%); use was lowest and disapproval highest in 1992 (14.5%, 86.3%, respectively). Cohort-specific trends indicated a similar inverse relation between use and disapproval as was observed by age and period; in general, disapproval increases concurrently to use decreasing.

Multi-level models

In an age-adjusted model for period effects of disapproval (Table 1), each 5% increase in disapproval was associated with a 13% decrease in the estimated odds of marijuana use (OR=0.87, 99% C.I. 0.86-0.89, $p<0.01$). Similarly, in an age-adjusted model for cohort effects of disapproval, each five percentage point increase in cohort-specific disapproval was associated with a 12% decrease in the estimated odds of marijuana use (OR=0.88, 99% C.I. 0.87-0.89, $p<0.01$).

We then estimated a model that included both cohort- and period-specific disapproval, enabling us to test for the effects of each with the other controlled (Table 2), as well as control for individual-level covariates of disapproval, perception of availability, perception of friends' use, age, sex, parental education, and race/ethnicity. Year- and cohort-specific disapproval was correlated at 0.78. Cohort-specific disapproval remained a significant predictor of marijuana use in the last 12 months (OR=0.88, 99% C.I. 0.87-0.89, $p=0.004$), whereas period-specific disapproval is no longer significant (OR=0.95, 99% C.I. 0.91-1.06, $p=0.07$).

Results when examining cohort- and period-specific disapproval as categorical variables are shown in Figure 2. There is a stepwise decrease in the odds of marijuana use as the cohort-specific disapproval increases. For example, compared to cohorts in which most (87-90.9%) adolescents disapproved of marijuana use, odds of marijuana use significantly increased in cohorts where less than half (42-46.9%) disapproved (OR=3.53, 99% C.I. 2.75, 4.53), controlling for individual disapproval,

perceptions of norms, friend's use, and socio-demographics. For period-specific disapproval, the relationship between disapproval and marijuana use was inconsistent. Those in the lowest disapproval periods (42-50.9%) have no decreased odds of marijuana use compared to those in the highest.

Sensitivity analysis: potential bias by age. Because only high school seniors were surveyed from 1976 to 1990, we were concerned that results could be confounded by age when examining overall trends from 1976 to 2007. We conducted two auxiliary analyses to examine this potential. First, we stratified each multi-level regression by year of observation, with one stratum indicating observation from 1976 through 1990 when only 12^{th} grade respondents were included, and one stratum indicating observation from 1991 forward when 8^{th}, 10^{th}, and 12^{th} grade respondents were included. The odds ratio for the effect of cohort changed from 0.88 to 0.90, and remained statistically significant. Second, we examined the relationship between cohort-specific disapproval and marijuana use within each age. Little variation in the odds ratio was found, ranging from 0.89 for age 14 to 0.75 for age 19. All odds ratios were statistically significant at $p<0.001$.

Sensitivity analysis: temporality. While we are interested in the hypothesis that social norms shape patterning of drug use, it is likely the case that, to some extent, patterning of drug use shapes the social norms in the community. To establish the temporal sequence between social norms predicting marijuana use, we created a one year time lag between marijuana use and the social norm of the birth cohort and time period. Thus, an individual's odds of marijuana use are predicted by the social norm of the n-1 time period and m-1 birth cohort, respectively. Results were unchanged. Shown in Online Table 1 is the relationship between period-specific, cohort-specific, and individual-level variables from a multi-level model with a one-year time lag. As shown, in the final model, cohort-specific disapproval remains significantly predictive of marijuana use (OR=0.87, 99% C.I. 0.83-0.92).

Discussion

The present study documents that adolescents who mature in birth cohorts with low disapproval of marijuana use are at higher risk of using marijuana during their teenage years, regardless of individual-

level disapproval, perceived social norms, or perceived availability. Disapproval across cohorts, defined at the population level through multi-level modeling, remained a robust risk factor controlling for disapproval in the time period in which the adolescent was assessed, the age of the adolescent at the time of assessment, the adolescent's personal disapproval and norms perceptions surrounding marijuana, and other socio-demographic risk factors. These findings are consistent with earlier reporting of cohort effects in attitudes about drugs based on the same study, but looking at later developmental periods, starting after high school graduation (4). Our finding that marijuana use is predicted by a cohort effect rather than a period effect suggests that adolescents are more influenced by individuals of similar age than by broad socio-cultural influences that affect all adolescents simultaneously (e.g., policy and law changes). We note, however, that period and cohort disapproval are strongly associated (correlation coefficient = 0.78) such that it may not be possible to fully disentangle the effect of one from the effect of the other.

Thus, these findings enhance our understanding of the basic relationship between social norms and marijuana use. Recent literature has indicated that student's individual-level perceptions of norms may not be salient predictors of marijuana use in adolescence (62); rather, prior drug use and peer affiliation alone explain the relationship between norm perception and use. Our results add to this literature by suggesting that aggregated norms measured at the group level provide explanatory power predicting marijuana use over and above individual-level attitudes and perceptions of norms. Further, birth cohort rather than period effects suggest that factors that aggregate within birth cohort specifically, rather than those that simply change across time, should be pursued when attempting to explain why marijuana use changes over time.

Sociological research has long documented that individuals are powerfully influenced by norms (63-65), and that social pressures towards group conformity influence the acquisition of norms and the decision to engage in behaviors once norms are internalized. The cohesive and collective power of societies and communities (sometimes termed 'collective efficacy' (66, 67)) to influence individual behavior has been documented for a range of health outcomes (67). These results indicate that birth

cohorts can be conceptualized as collective agencies at the structural level (68, 69), with attributes (e.g., the acceptance of marijuana use) that have no exact analogue at the individual level.

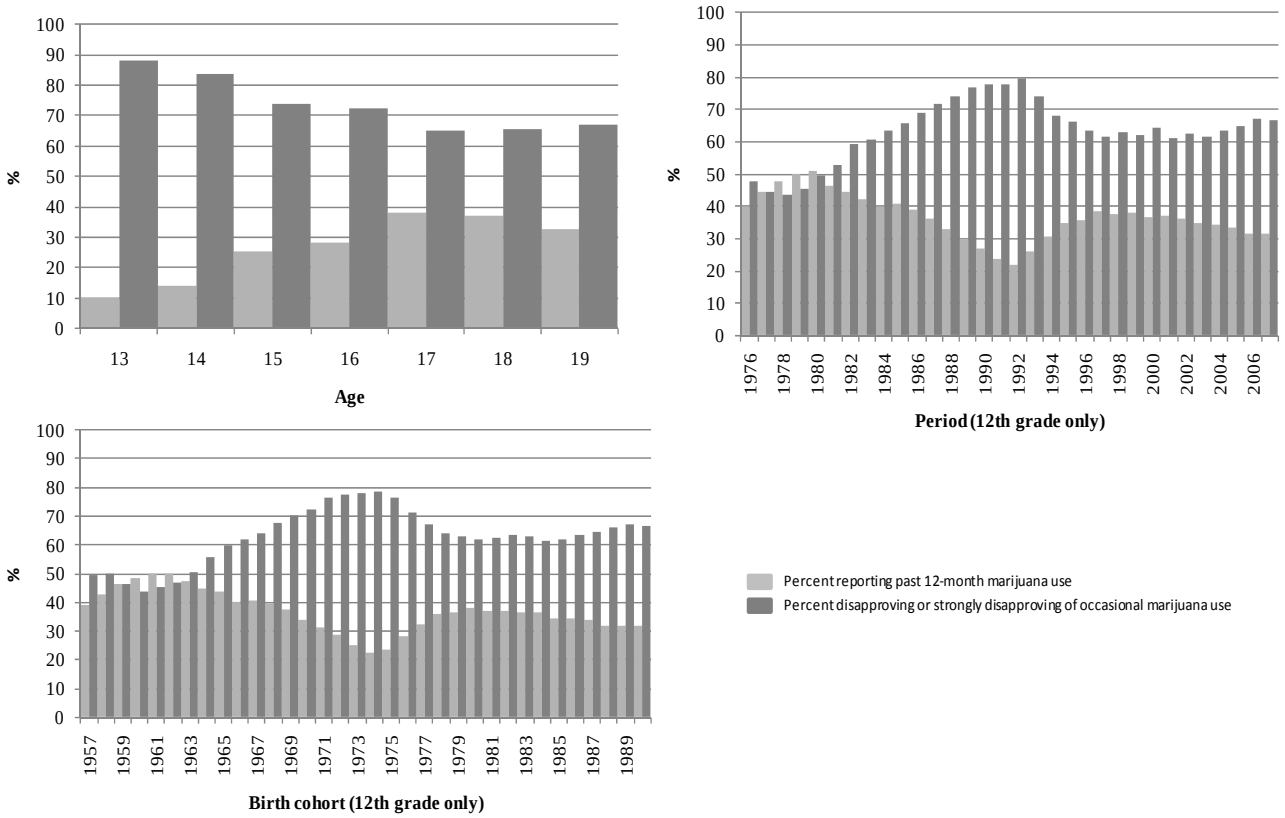
The present study represents a methodological advance combining two recently emerging lines of thinking in age-period-cohort research and methods. First, Yang and colleagues (54-56) have proposed the use of multi-level modeling to overcome methodological issues in the simultaneous estimation of age, period, and cohort effects, with period and cohort cross-classified as random effects. However, they have not incorporated potential explanatory mechanisms in their work. Second, Winship and Harding (70) have proposed that age-period-cohort research is most informative when the mechanisms hypothesized to underlie age effects, period effects, and cohort effects are explicitly tested. However, they have not used multi-level models to test mechanistic variables. The present paper is the first, to our knowledge, to combine these two methods, utilizing a multi-level model with a mechanism hypothesized to underlie period and cohort effects specified as an explanatory variable at the group level. Previous research has shown a combination of birth cohort and period effects in marijuana use over time among both adolescents (45-47) and adults (48); we extend this research by examining one potential group-level mechanism through which birth cohort effects in marijuana use emerge: changing social norms. (54-56).

Results in this paper support a range of theories regarding the role of the environment in the transmission of health behaviors such as marijuana use. Observational learning theory suggests that individuals may model behavior that is passively observed in the environment, independent of direct positive or negative reinforcement (71-73). The impact of observational learning on marijuana use has been previously tested, especially in substance intervention research (74-78). Johnston (79) posits that epidemics of drug use occur within and across socio-historical time periods due to a combination of factors, including willingness to violate disapproving social norms as well as access to and awareness of the drug, suggesting a strong role for social norms and other group-level processes such as laws and policies in the propagation of drug epidemics among adolescent populations. Further testing of mechanistic models will aid in the elucidation birth cohort and time period influence on adolescent marijuana use.

Limitations of the study are noted. Participation in the survey may be somewhat associated with disapproval of marijuana use; more rule-abiding students may be more likely to both participate and disapprove of marijuana use. This would bias results if participation rates exhibited similar temporal trends as marijuana use (80), however, participation rates are high across all years (77-91%) and exhibit no temporal trends (2) suggesting little threat to validity by informative participation. Further, we did not have information on the geographical norms for each student (e.g. school, neighborhood, county, state, etc.). Substantial research has indicated that variability in geographic norms is an important predictor of marijuana use (81-83), and this literature would be enriched by future studies that incorporate both geographical and temporal norms. Finally, because MTF is a school-based survey, high school drop-outs are not included in any survey estimates. This is a minor issue for the eighth grade survey; however, by tenth grade approximately 5% of adolescents drop-out, and by twelfth grade between 15 to 20% of each cohort is missing due to drop out (2). The conclusions from this study can be generalized only to students attending high school, which represent the large majority of adolescents in the United States.

Despite these limitations, the present study represents an important advance in the understanding of multi-level effects on marijuana use. This study lays the foundation for future work on the population-level effects of social norms and provides compelling evidence regarding the advantages of ongoing cohort sequential designs. Building on this foundation and such designs, future research should recognize and model the non-independence of individuals born in the same year, and test hypotheses about the mechanisms through which norms may exert an influence on marijuana use and other problem and health related behaviors. As more comprehensive models of the etiology of adolescent marijuana use are developed, the risk conferred by time and place are important components to understand.

Figure 1. Percentage of past year marijuana use and percentage of marijuana use disapproval by age, periods of observation (12th grade only*) and birth cohorts (12th grade only*) among U.S. adolescents, 1976-2006



*8th and 10th grades were added in 1991 forward; trends are similar for 8th and 10th grades as for 12th grades although absolute magnitude of marijuana is lower and disapproval higher.

Table 1. Multi-level models for the period- and cohort-level associations between past-year marijuana use, year-specific disapproval and cohort-specific disapproval, controlling for age at the individual-level (N=986,003)

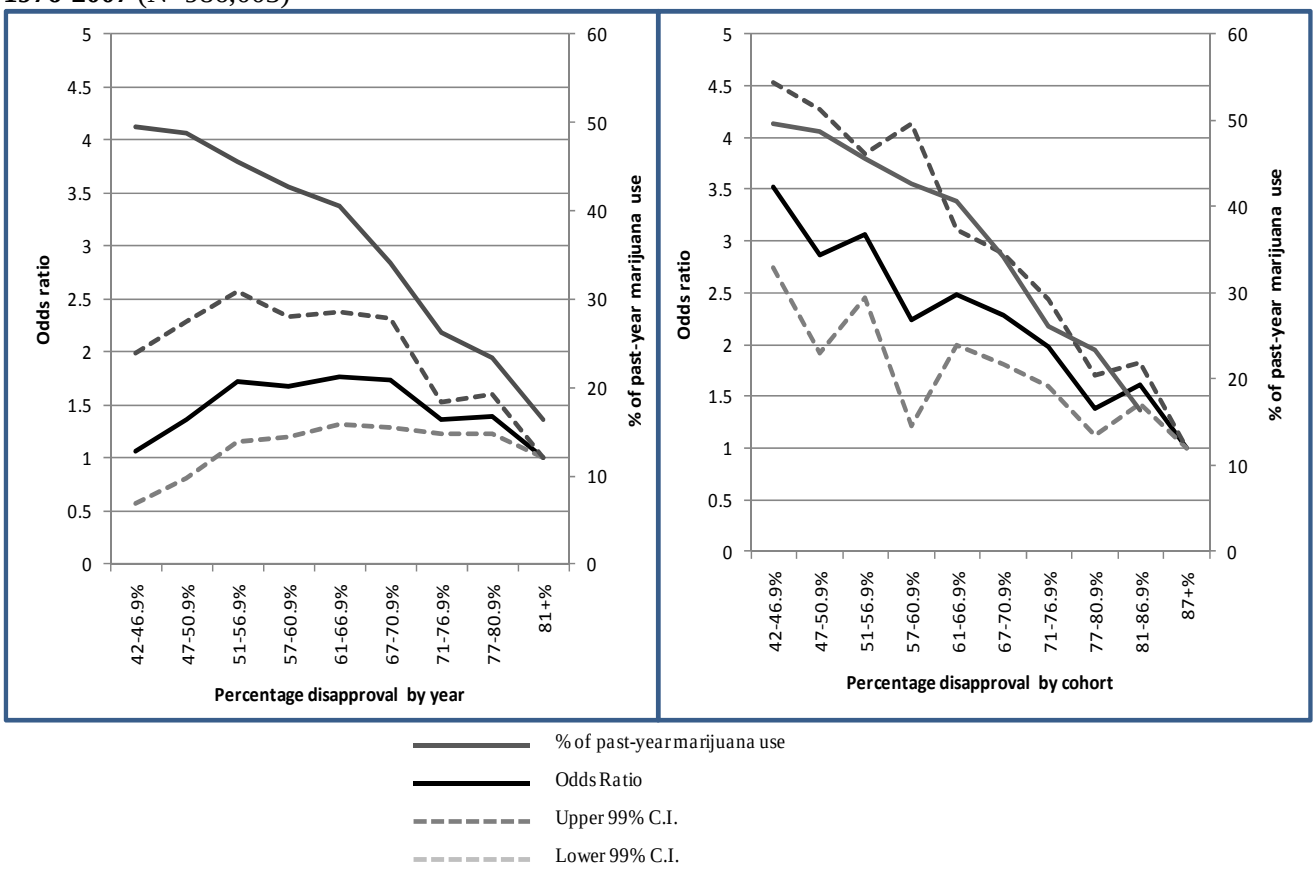
	Model 1*			Model 2*		
	OR	99% Confidence interval	p-value	OR	99% Confidence interval	p-value
Period-specific disapproval	0.87	(0.86-0.89)	<0.01			
Cohort-specific disapproval	--		--	0.88	(0.87-0.89)	<0.01
Age	1.32	(1.26-1.38)	<0.01	1.30	(1.27-1.33)	<0.01
R-squared within	0.060		<0.01	0.065		<0.01
R-squared between	0.854		<0.01	0.760		<0.01

* Model 1 contains only period-specific disapproval at the group level and age at the individual-level. Model 2 contains only cohort-specific disapproval at the group level and age at the individual level.

Table 2. Multi-level model for the year- and cohort-level associations between past-year marijuana use, year-specific disapproval and cohort-specific disapproval, controlling for age, race, sex, disapproval and perceptions of friends' use at the individual-level (N=986,003)

		OR	99% Confidence interval	p-value
Group-level covariates:				
Year-specific disapproval		0.95	(0.91-1.06)	0.07
Cohort-specific disapproval		0.88	(0.87-0.89)	0.004
Individual-level covariates:				
Individual attitude:				
	Strongly disapprove	15.38	(14.34-16.49)	<0.001
	Disapprove	3.43	(3.25-3.62)	<0.001
	Don't disapprove	1.00		
Proportion of friends who use:				
	All	23.88	(17.26-33.03)	<0.001
	Most	13.71	(10.12-18.58)	<0.001
	Some	6.1	(4.61-8.08)	<0.001
	A few	2.79	(2.16-3.61)	<0.001
	None	1.00		
Ease of marijuana access:				
	Very easy	5.42	(4.60-6.39)	<0.001
	Fairly easy	3.23	(3.01-4.13)	<0.001
	Fairly difficult	2.13	(1.86-2.43)	<0.001
	Very difficult	1.4	(0.94-1.64)	0.3
	Probably impossible	1.00		
Age		1.04	(1.01-1.08)	0.003
Race/ethnicity:				
	Non-white	0.68	(0.61-0.77)	<0.001
	White	1.00		
Sex:				
	Male	1.16	(1.12-1.21)	<0.001
	Female	1.00		
Highest parental education:				
	More than high school	0.80	(0.75-0.84)	<0.001
	High school	0.71	(0.66-0.76)	<0.001
	Less than high school	1.00		
R-Squared within	0.605, p<0.01			
R-squared between	0.825, p<0.01			

Figure 2. Percentage of past-year marijuana use and odds ratio for the effect of cohort-specific and period-specific disapproval on past year marijuana use among high school students in the U.S. from 1976-2007 (N=986,003)



Online Table 1. Multi-level model for the *N-1 year- and cohort-level associations between past-year marijuana use, year-specific disapproval and cohort-specific disapproval, controlling for age, race, sex, disapproval and perceptions of friends' use at the individual-level** (N=986,003)

		OR	99% Confidence interval	p-value
***N-1** year-specific disapproval*		0.96	(0.87-1.07)	0.13
***N-1** cohort-specific disapproval*		**0.87**	**(0.83-0.92)**	**0.004**
Individual-level covariates:				
Individual attitude:				
	Strongly disapprove	**15.39**	**(14.32-16.55)**	**<0.001**
	Disapprove	**3.43**	**(3.25-3.63)**	**<0.001**
	Don't disapprove	**1.00**		
Proportion of friends who use:				
	All	**23.45**	**(16.78-32.78)**	**<0.001**
	Most	**13.5**	**(9.84-18.54)**	**<0.001**
	Some	**6.02**	**(4.49-8.08)**	**<0.001**
	A few	**2.76**	**(2.11-3.62)**	**<0.001**
	None	1.00		
Ease of marijuana access:				
	Very easy	**5.45**	**(4.62-6.43)**	**<0.001**
	Fairly easy	**3.54**	**(3.02-4.14)**	**<0.001**
	Fairly difficult	**2.13**	**(1.86-2.43)**	**<0.001**
	Very difficult	**1.4**	**(1.19-1.64)**	**<0.001**
	Probably impossible	1.00		
Age		**1.04**	**(1.01-1.07)**	**0.003**
Race/ethnicity:				
	Non-white	**0.68**	**(0.61-0.77)**	**<0.001**
	White	1.00		
Sex:				
	Male	**1.16**	**(1.12-1.20)**	**<0.001**
	Female	1.00		
Highest parental education:				
	More than high school	**0.8**	**(0.76-0.84)**	**<0.001**
	High school	**0.71**	**(0.66-0.75)**	**<0.001**
	Less than high school	1.00		

*N-1 refers to the year- and cohort-specific disapproval in the year prior to the observation and birth year of each respondent. For example, for an individual observed in 2005 in the 1990 birth cohort, the values for year- and cohort-specific disapproval would be those for the period of 2004 and the 1989 cohort, respectively.

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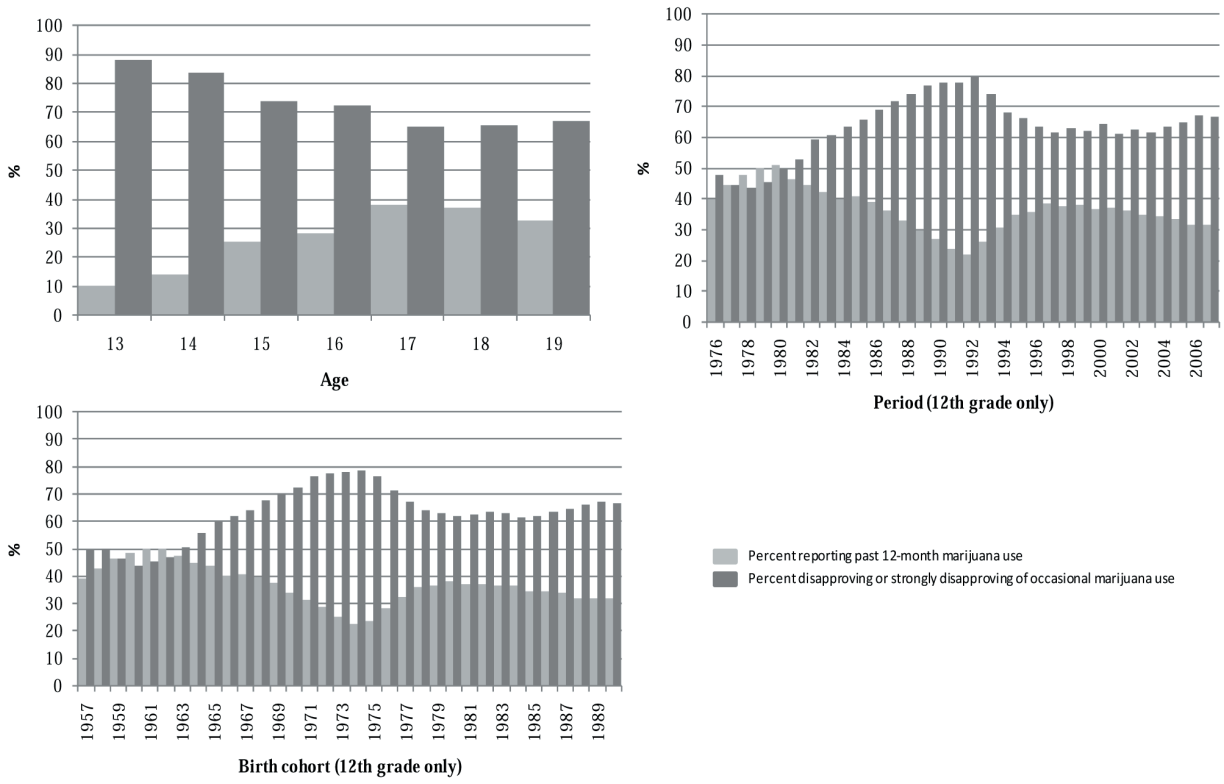
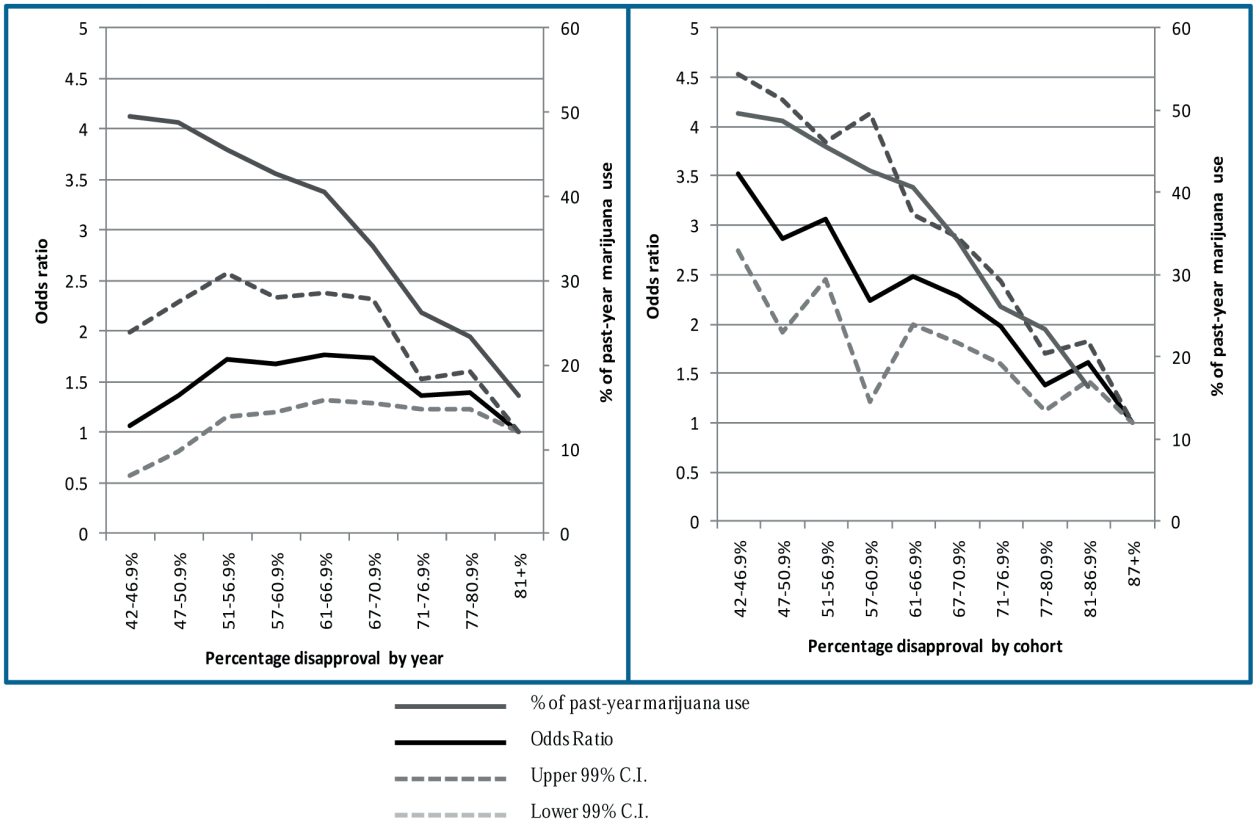


*8th and 10th grades were added in 1991 forward; trends are similar for 8th and 10th grades as for 12th grades although absolute magnitude of marijuana is lower and disapproval higher.

f1


Odds ratio
% of past-year marijuana use
42-46.9%
47-50.9%
51-56.9%
57-60.9%
61-66.9%
67-70.9%
71-76.9%
77-80.9%
81+%
Percentage disapproval by year
Odds ratio
% of past-year marijuana use
42-46.9%
47-50.9%
51-56.9%
57-60.9%
61-66.9%
67-70.9%
71-76.9%
77-80.9%
81-86.9%
87+%
Percentage disapproval by cohort
% of past-year marijuana use
Odds Ratio
Upper 99% C.I.
Lower 99% C.I.

f2