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Trends in U.S., Past-Year Marijuana Use from 1985–2009; An Age-Period-Cohort Analysis

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Abstract

Background—We present a formal age-period-cohort analysis to examine if the recent increase in past-year marijuana use among the young is specific to the younger generation or if, instead, it is part of a general increase present across cohorts of all ages. This is the first age-period-cohort analysis of past-year marijuana use that includes adult trends from 2001–09.

Methods—Data come from the National Survey on Drug Use and Health, a series of annual, nationally-representative, cross-sectional surveys of the U.S. civilian, non-institutionalized population. The analysis focuses on the 25 year time span from 1985–2009 and uses the recently developed 'intrinsic estimator' algorithm to estimate independent effects of age, period, and cohort.

Results—The recent increase in past-year marijuana use is not unique to the youngest birth cohorts. An independent, positive influence of cohort membership on past-year marijuana use, net of historical period and age effects, is smaller for today's youngest cohorts than it was for the cohorts that came immediately before, and, in fact, is at its lowest level in three decades. The recent increase in marijuana use among the young is more consistent with a historical period effect that has acted across all cohorts. Period and cohort trends differ substantially for Hispanics.

Conclusions—The major forces that drive trends in past-year marijuana use are moving away from cohort-specific factors and toward broad-based influences that affect cohorts of all ages. Strategic public health and policy efforts aimed at countering the recent increase in past-year marijuana use should do the same.

Introduction

Much remains unknown about trends in past-year marijuana use during the first decade of the 21st century. Higher rates of marijuana use among today's youth suggest that today's younger generation may have developed a unique taste for marijuana that was not present among previous birth cohorts (NIDA, 2011). A full and accurate consideration of this possibility requires a formal age-period-cohort analysis to determine if the recent increase in marijuana use among the young is specific to the younger generation or if, instead, it is part of a general increase present across all age groups. Currently no such analysis exists for adult trends in past-year marijuana past the year 2000.

This study presents an age-period-cohort analysis of past-year marijuana use and contributes to the literature in two main ways. First, we update the only other age-period-cohort analysis of adult, past-year marijuana use (Kerr et al., 2007) and extend analysis to the years 2001–

2009. Second, to our knowledge this paper is the first to examine potential differences across race/ethnicity in age-period-cohort marijuana trends, an examination made possible by the large statistical power of the data we use.

Background

Historical trends in any outcome are a function of birth cohort, historical period, and age influences. For example, marijuana prevalence among adults age 20–25 may increase from the year 2000 to 2010. If this is a general increase that affected all cohorts then it is a "historical period" effect. In contrast, if this increase is found only among adults age 20–25 in 2010 then it would represent a "birth cohort" effect. Separating historical period and cohort effects is complicated by the fact that many outcomes vary substantially by age; in this case, past year marijuana prevalence declines substantially with advancing age (Kerr et al., 2007). It is therefore necessary for statistical analysis to, in effect, compare birth cohorts at similar ages. A formal age-period-cohort analysis provides separate estimates for these three influences net of each other.

To date, only one formal age-period-cohort analyses has focused on the outcome of adult, past year marijuana use (Kerr et al., 2007). It combined nationally-representative data from the four survey years of 1984, 1990, 1995, and 2000 for an analysis pool consisting of 19,341 individuals (Kerr et al., 2007). An independent, positive influence of cohort on past-year marijuana use, net of historical period and age effects, was uniquely high for the baby boom cohort (defined as people born between 1946 and 1964, U.S. Census Bureau, 2006) and declined for later cohorts, at least for men. In terms of broad, historical period effects the analysis indicated that from 1984 to 2000 past year marijuana use declined for all cohorts among men, and appeared to increase among women. Finally, for both men and women the prevalence of marijuana use declined with advancing age.

This project extends the time frame of the Kerr analysis to include the years 2001–2009. Marijuana trends during these years warrant study in light of evidence that past year marijuana use has increased. For example, among 12th graders past year marijuana use increased monotonically from 31.5% in 2006 to 34.8% in 2010 (Table D-9, Johnston et al., 2011). Past year marijuana use among adults also trends in the same direction during this time period and for all age groups past year marijuana prevalence increased from 2006 to 2009 (the most recent year currently available); for example, among respondents age 26–29 the prevalence increased from 17.2% to 25.5% and for respondents age 30–34 it increased from 11.7% to 18.2% (See Tables 1.12B and 1.11B in Office of Applied Studies, 2007, 2010). These trends suggest the presence of a recent historical period effect that increased past year marijuana use for all cohorts, although no formal age-period-cohort analysis has yet documented it. Information on whether an increase in past year marijuana use is general to all birth cohorts or specific to the young can help focus research aimed at identifying the specific mechanisms at work as well as guide policy aimed at countering the trend.

This project also expands the scope of racial/ethnic groups considered in age-period-cohort analyses of past year marijuana use. The existing age-period-cohort analysis of adult marijuana use did not stratify by race/ethnicity, most likely because of statistical power limitations. The data set for this analysis is more than 40 times larger, and provides the opportunity for separate analyses of Hispanic, non-Hispanic black, and non-Hispanic white respondents.

Analyses of the Hispanic respondents are of particular interest. The ranking of Hispanics for past year marijuana use in relation to other racial/ethnic groups differs dramatically by age group. While Hispanics rank highest during adolescence (Johnston et al., 2011), they rank lowest among those age 26 and over (Table 1.27B, Substance Abuse and Mental Health Services Administration, 2010). In this project we examine whether cohort differences drive this finding across age groups, or if Hispanics ‘age out’ of marijuana use at a faster pace.

Methods

Data for the analysis come from the National Survey on Drug Use and Health (NSDUH), a series of annual, nationally-representative, cross-sectional surveys of the U.S. civilian, non-institutionalized population. This study uses all surveys available, which comprises of the years 1985, 1988, and every year from 1990 to 2009 inclusive.

The NHSDA was designed to provide estimates of the prevalence of illegal and legal drugs in the household population of the United States. These surveys used a multistage probability sample, with minor variation in the sampling frame over the years from 1985 to present. African-Americans, Hispanics, and young people were oversampled to increase the precision of estimates for these groups. The analyses focus on respondents aged 15–64 at each survey wave, for a total of 776,242 respondents.

The survey has undergone methodological improvements over time that have led to higher, and presumably more accurate estimates of drug use. The two major improvements were (1) a shift from paper-and-pencil to computer-assisted surveys in 1999 and (2) the introduction of respondent incentives in 2002 (Kennet and Gfroerer, 2005).

Interviews were conducted in the home by trained interviewers. To maximize the validity of responses and to minimize under-reporting, respondents answered questions about possible sensitive issues, such as illegal drug use, using a self-administered format. Response rates were typically 80% or higher. All information is self-reported. More detailed information about the survey is available at the SAMHSA website at http://www.oas.samhsa.gov/nhsda.htm.

Past-year marijuana use is expressed as the function:

$$\text{Logit}(\text{Y}_{\text{ij}})=\alpha+C_{\text{k}}+P_{\text{j}}+A_{\text{i}}+\text{e}_{\text{ij}} \quad (1)$$

where the effect of the k-th cohort is given by C_k, the effect of the j-th period by P_j, and the effect of the i-th age group is given by A_i; where α is a constant and e_{ij} is random disturbance. The age-period-cohort algorithm used in this analysis requires cells of equal time duration and in this study age, period, and cohort were each subdivided into five-year groups. Age consists of ten five-year groups starting with age 15–19 and ending with age 60–64, and cohort consists of 14 five-year periods starting at 1925. We follow demographic convention and each quinquennial cohort starts at a year that is a multiple of five.

The “intrinsic estimator” approach (Yang, 2008) is a principle components estimator that provides a unique solution to equation (1) and provides one way to addresses issues of empirical identification that make it challenging to find a single solution for this model (Glenn, 2003). We use the publicly available add-on file for the “intrinsic estimator” algorithm (Yang, 2008) available in StataMP version 9.0.(StataCorp, 2005). All analyses are weighted to take into account the complex survey design. Data from all surveys were included in one analysis pool and data from each survey were assigned unique strata numbers to adjust standard errors for design effects (Korn and Graubard, 1999).

Results

Figure 1 presents the observed prevalence of past-year marijuana use by age groups, sex, and survey year. In keeping with the other, previously published age-period-cohort analysis of adult past-year marijuana use we present the age groups of 25 or less as well as 26 or older, although we stratify the 26 and older group into age 26–34, 35–49, and 50–64.

Four main findings are apparent in Figure 1. First, prevalence of past-year marijuana use varies substantially by age group. Rates are highest among the youngest groups, and decline monotonically with age for both men and women at all survey waves. Among men the prevalence declines from at least 25% down to 8% or less across the age groups of 15–25 to 50–64, while for women prevalence declines from an average of about 20% to less than 5% for these same age groups.

Second, the prevalence of past-year marijuana use changes substantially across the survey waves for both men and women. For some years changes in prevalence move in concert across all age groups, a pattern consistent with an historical period effect. For example, across most age groups an upswing in prevalence is apparent from the mid 1990s to the last survey wave in 2009. For some years changes in prevalence are concentrated in specific age groups, a pattern consistent with a cohort effect. For example, a substantial decline in prevalence from 1985 to the mid 1990s is apparent in the younger age groups (age 15–34, when the baby boom exited this age category), but not for the older ones.

Third, an increase in prevalence that is potentially a methodological artifact is apparent across all age groups and for both sexes across the years 2001 and 2002. In 2002 the survey first introduced monetary incentives to respondents for their participation in the survey, a change that contributes to at least part of this increase (Kennet and Gfroerer, 2005). The prevalence in year 2002 as compared to 2001 is about 20% larger for all age categories among both men and women. Little systematic change in the prevalence of past-year marijuana use is apparent from 1998 to 1999, when the survey switched from paper-and-pencil to computer-assisted interviews.

A fourth finding is that the overall pattern of results is similar for men and women. For both sexes prevalence declines substantially across age groups, increases in prevalence move in concert across most age groups from the mid 1990s to 2009, a decline in prevalence is concentrated among the younger age groups from 1985 to the mid 1990s, and a methodological artifact appears to increase marijuana prevalence slightly from 2001 to 2002.

Table 1 presents results from the age-period-cohort analysis for past year marijuana use among men and women (presented graphically in Figure 2). Table 1 presents unexponentiated coefficients that each sum to zero within the cohort, period, and age estimate groups. The null hypothesis of no cohort, period, or age effects would be indicated by uniform coefficients of zero within the cohort, period, or age groups. Nonzero coefficients indicate age, period, or cohort effects and the exponentiation of these coefficients provides the odds ratio. For example, the value of .788 for the 1955–59 birth cohort among men indicates that membership in this birth nearly doubled the odds ($e^{.788}$=2.20) of past year marijuana use in comparison to all cohorts combined, independent of historical period and age.

Trends in age, period, and cohort effects are indicated by comparison of coefficients across time periods. For example, an increase in the magnitude of the "period" coefficients from 1995–99 to 2000–04 would indicate increasing, overall prevalence of past-year marijuana use, a decrease in the magnitude of the coefficients would indicate decreasing period effects, and no change in magnitude would indicate constant period effects.

Table 1 indicates that the independent influence of cohort on past year marijuana use was strongest for the baby boom cohort (those born between 1946 and 1964). For example, the influence of birth cohort for respondents born between 1955 and 1959 was about twice as high as the odds for all cohorts combined ($e^{.742}$=2.10 and $e^{.788}$=2.20, Table 1). The independent influence of cohort on past year marijuana use, net of age and historical period effects, gradually declined for subsequent cohorts so that the most recent birth cohort (born 1990–94) did not significantly differ from the mean of all cohorts combined.

Table 1 also presents the independent influence of age on past year marijuana use, taking into account historical period and birth cohort influences. Age acts as expected, and for both men and women past year marijuana use is highest among the young and decreases with advancing age. For both men and women the odds of past year marijuana use for youth age 15–24 were about five times higher than they were for all ages combined. For older adults age 60–64 the odds of past year marijuana use were about four or five times lower than they were for all ages combined.

In analysis not shown we considered the possibility that the influence of age may have strengthened or diminished over the analysis period. We ran an additional age-period-cohort model for an abbreviated sample that consisted of only the years 1985 to 1999. For both men and women age had the same influence for this earlier time portion as compared to the analysis pool that included all time points. Specifically, in the abbreviated sample the odds of past year marijuana use for youth age 15–24 were about five times higher than they were for all ages combined, these odds diminished with advancing age, and for older adults age 60–64 the odds of past year marijuana use were about five times lower than they were for all ages combined.

Table 1 also presents estimates of the independent influence of historical period effects. These period effects are changes in the prevalence of past year marijuana use that took place simultaneously across all ages and birth cohorts, after taking into account influences specific to particular birth cohorts and age groups. The results indicate that the independent influence of historical period followed a U-shaped curve for both men and women in which past year marijuana use decreased until its lowest point between 1990–1999 and increased afterwards. The results indicate that for both men and women the odds of past year marijuana use were almost 50% higher in 2005–2009 as compared to 1995–99 (calculated as the difference in the coefficients for the 2005–09 period and the 1995–99 period, which for women is $e^{.195 - -.204}$=1.49 and for men is $e^{.195 - -.176}$=1.45). However, as discussed in more detail in the Discussion section this 50% estimate is almost certainly inflated as a result of a methodological improvement that took place in 2002 and the true, substantive increase is somewhat smaller.

Table 2 presents results from the age-period-cohort analysis for past year marijuana use by race/ethnicity, and Figure 3 is a graph of these results. The results for white and black respondents are similar to the results for all races and ethnicities combined presented in Table 1 and Figure 2. Specifically, the positive, independent influence of cohort on past year marijuana use is strongest for the baby boomers, and this influence decreased with subsequent cohorts. The three most recent, quinquennial birth cohorts show monotonic, declining odds of past year marijuana use. For whites and blacks historical period influences that affected all cohorts show a decrease in past year marijuana use from 1985 to 1999 and then an increase from 2000 to 2009. Finally, both blacks and whites show the expected pattern of age effects, in which past year marijuana use is highest among the young and decreases with advancing age.

Hispanics stand out with a distinct pattern of past year marijuana use. No baby boom cohort effect is present. The strongest influence of cohort is among the youngest generation, and not among the baby boomers. Also, among Hispanics the historical period effects also appear to follow a different pattern in comparison to black and white respondents and for Hispanics the period effect declines and then plateaus, and does not reverse during the years 2000–2009.

Discussion

This study presents the first age-period-cohort analysis of adult, past year marijuana use that examines trends in the 21st century (up to the year 2009), presents the first analysis of potential differences in age-period-cohort trends across race/ethnicity, and makes use of recent developments in age-period-cohort methodology.

The analysis documents two main findings, which we discuss in more detail below. First, the positive, independent influence of cohort membership on past-year marijuana use, net of historical period and age effects, is smaller for today’s youngest cohorts than it was for the cohorts that came immediately before them. These results suggest that the recent increase in marijuana use among the young is a general historical period effect that affected cohorts of all ages, and the analysis finds evidence for such an effect. Second, Hispanic respondents show a very different pattern of results in comparison to non-Hispanic whites and non-Hispanic blacks.

The most recent birth cohorts do not show a unique proclivity for marijuana use. The independent influence of cohort on past-year marijuana use indicates the extent to which a birth cohort has a unique prevalence of marijuana use that is not explained by historical period or age effects. This effect is smaller for today's youngest cohorts than it was for the ones that came immediately before them and this effect has been in a steady decline since the 1955–59 birth cohort. The decreasing size of the cohort effect indicates that cohort-specific influences are increasingly turning youth away from marijuana in comparison to previous cohorts.

If the recent increase in past-year marijuana use among the young is not a result of cohort-specific influences, then it should stem from a historical period effect that increased prevalence across all birth cohorts. The analysis provides evidence for this historical period influence, and indicates that for both men and women across all cohorts the odds of past year marijuana use were almost 50% higher in 2005–2009 as compared to 1995–99.

It is important to note that this historical period increase of 50% is almost certainly inflated. In 2002 the NSDUH survey first offered monetary incentives to respondents, which led to about a 20% increase in marijuana prevalence across all age groups as compared to the previous year (see Figure 1). Such a uniform increase in marijuana prevalence rates does not occur in any other year. Because this increase in marijuana prevalence in the year 2002 occurred across all age groups, it will show up in the estimates as a "historical period" effect and not a cohort or age effect. If the 20% increase in marijuana prevalence across 2001 and 2002 is ascribed entirely to the methodological improvement, then about half of the 50% historical period increase from 1995–99 to 2005–2009 is a methodological artifact that occurred in 2002 and about half is substantive.

Taken as a whole, these results indicate that trends in marijuana use appear to be transitioning away from cohort-specific process and towards general ones that affect all cohorts, a transition with important implications for theory and policy. Cohort-specific processes were at their peak influence with the baby-boom cohort, which had the highest cohort-specific prevalence of past marijuana use of all cohorts in the analysis period. In subsequent years cohort-specific influences have steadily and cumulatively decreased, and this trend consequently gives relatively more influence to historical period effects.

These findings draw attention to factors that affect marijuana prevalence across cohorts of all ages, not just the young. Social norms such as perceived harmfulness and perceived disapproval of marijuana warrant particular attention in light of evidence that they are strong predictors and, most likely, strong drivers of marijuana prevalence trends (Bachman et al., 1988; Bachman et al., 1998). Recent work shows that societal norms toward marijuana use have a strong influence on individual marijuana use independent of an individual's personal attitudes toward marijuana (Keyes et al., 2011). Up to now these societal norms have clustered within birth cohorts (Keyes et al., 2011), and the findings of this study suggest the growing influence of general changes in these norms that affect cohorts of all ages. Current advertising campaigns aimed at changing these marijuana norms specifically target the young (Slater et al., 2011), and the results of this project suggest it would be strategic to expand this campaign to target adults as well.

A growing influence of historical period influences for marijuana trends has important consequences for the “normalization” hypothesis (Measham and Shiner, 2009; Parker, 2005; Parker et al., 1998; Parker et al., 2002). This line of research posits that the growing prevalence of marijuana use over historical time stems from a cohort process in which young cohorts “self-medicate the impact of the stresses and strains of both success and failure in ‘modern’ times” (page 152, Parker et al., 1998) and these cohorts then persist using marijuana use as they age. However, the results of this study show that younger cohorts definitely did *not* drive recent increases in marijuana use. The study findings therefore present an opportunity and motivation for normalization theorists to examine historical period processes in addition to cohort processes, and thereby address the recent call from within the field to address the question “Is there evidence supporting normalization in all age groups?” (p. 138, Erickson and Hathaway, 2010).

A final, major finding of this study is that the distribution of past year marijuana use by birth cohorts differs substantially by race/ethnicity. Specifically, Hispanics are unique because the baby boom cohort does not have the highest prevalence of past year marijuana use in comparison to other cohorts and, further, the prevalence of past year marijuana use did not increase from 2001–09 as it did for other racial/ethnic groups. Most likely, higher migration rates for Hispanics will play an explanatory role for this finding. For example, in the year 2000 among adults of baby boom age only 37% of Hispanics were born in the U.S. or to a U.S. parent abroad, as compared to 96% of non-Hispanics whites and 91% non-Hispanic blacks (Gassoumis et al., 2010). This suggests that many of the Hispanics in the U.S. today who are of baby boom age did not grow up in the U.S. social environment that led to the unique drug behaviors of baby boomers, and instead their drug behaviors were shaped by their parent country. This finding suggests that the rapid drop off in Hispanic, past year marijuana prevalence rates across advancing age groups is not the result of a unique aging effect for Hispanics, but rather represents a cohort effect in which Hispanics at older ages represent a population with fundamentally different social determinants of marijuana use than younger Hispanics.

Whatever the underlying reason for the unique marijuana behaviors of Hispanics, the results of this study suggest that when possible they should be treated separately in the analysis of marijuana trends. Doing so will lead to increased historical period effects as well as stronger baby boom effects for non-Hispanics. Further, future studies are expected to report increasing past year marijuana prevalence rates among older Hispanics, to the extent that the future group of middle aged and older U.S. Hispanics is expected to be increasingly native-born (Pew Hispanic Center, 2011).

There are notable differences in the substantive conclusions of this study in comparison to the previous age-period-cohorts analysis of past year marijuana use (Kerr et al., 2007), and these differences are not simply a consequence of the different time spans considered. Whereas the results of this study showed a declining prevalence of past year marijuana use for both men and women from 1985–1999, the previous analysis by Kerr et al. found a decline for men only. Further, the Kerr report indicated that among women the recent birth cohorts such as those born 1980–84 and 1985–89 had a rate of past-year marijuana prevalence that was similar to that of the baby boom cohort.

Most likely these differences result from the different survey methods of the two analyses. Kerr et al. based their analysis on the National Alcohol Study (NAS) which, as the name implies, centers on alcohol use and its correlates and is not specifically designed to assess illegal activities. The NAS employed face-to-face interviews that required respondents to directly report illegal drug behaviors to interviewers (in the year 2000 the interview was done over the phone). In contrast, the NSDUH data of this project was based on self-interviewing methods with computer or paper, and the interview process emphasized to respondents that they would receive high levels of confidentiality. While it is difficult to predict the specific influence of the different methodologies on the results, the methodology of the NSDUH data used in this study seems better suited for analysis of illegal behaviors such as marijuana use.

This study has limitations. First, the results are subject to the limitations inherent to self-report surveys, as are all national surveys of drug use. Evidence to date indicates that self-reported illegal drug use is valid when respondents believe their confidentiality is protected (O'Malley et al., 1983), and the NSDUH emphasizes to respondents the efforts it makes to ensure confidentiality. To the extent that self-reports introduces biases that are constant over time, such biases would not change the substantive conclusions of this study because the analysis focuses on changes over time and not on the actual level of marijuana use in any specific year.

A second limitation is that two methodological improvement in the NSDUH over time potentially bias 'historical period' influences upward. Increased prevalence of past year marijuana use may in part be an artifact of the shift from paper-and-pencil to computer-assisted surveys in 1999 and the introduction of respondent incentives in 2002 (Kennet and Gfroerer, 2005). The graph of the observed data (Figure 1) suggests that the shift from paper-and-pencil in 1999 did not have much influence on the outcome of past year marijuana in light of the fact that little change in prevalence is apparent from 1998 to 1999. In contrast, the introduction of respondent incentives in 2002 appears to have increased reports of past year marijuana use by about 20%, a likely methodological artifact that we emphasize in the Discussion. Because this methodological change influences prevalence across all age groups, it shows up in the analysis as a historical period effect. This methodological improvement does not affect the estimated cohort effects or aging effects, for which the historical period effects serve as an important control.

Third, the age-period-cohort analysis of this analysis is based on the assumption that the magnitude of the age influence on past year marijuana use has not changed over historical time, an assumption that if violated could lead to misestimation of cohort and period effects. Our analysis does not find evidence that the influence of age change substantially over the analysis period of this study (see Results), but it is possible that the influence of age may change in the future. The assumption of a steady influence of age over historical time is particularly important for the estimation of cohort effects for the youngest cohorts, who contribute only a few years of data to the analysis because they are only 15–19 in the final survey wave.

A final limitation of the study is that it considers only a limited number of demographic factors that may influence past year marijuana use. Specifically, the analysis examines the influence of sex and race/ethnicity, both of which are permanent characteristics that support interpretations of one-way causality. Other demographic factors that also play a role in marijuana use include socioeconomic status, marital status, and region of the country. A careful consideration of these factors would require a review of the literature for evidence on how they are related to marijuana use, as well as a methodology and interpretation that take into account possible bidirectional causation. We hope that this study will lay the foundation for future analyses such as these, which are beyond the scope of this paper.

Conclusion

The increasing rate of past year marijuana use among the young is more consistent with a general increase in marijuana use across all age groups than it is with a cohort-specific influence unique to the youngest cohorts. It is therefore strategic for efforts aimed at specifying the driving forces behind the recent increase in marijuana use to focus on general determinants of marijuana use that affect all age groups, and not on determinants specific to adolescence and young adulthood. Such efforts are of key importance in addressing marijuana use and developing policies to address it.

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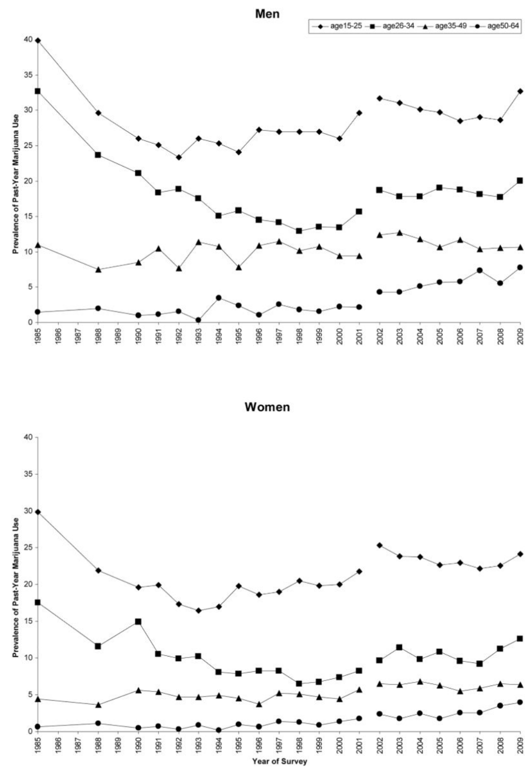

Figure 1.
Observed Prevalence of Past-Year Marijuana Use by Age Groups, Sex, and Survey Year
Note: Prevalence estimates in 2002 as compared to previous years are slightly inflated due to a methodological change. In 2002 the National Survey on Drug Use and Health first began offering monetary incentives to respondents for their participation.

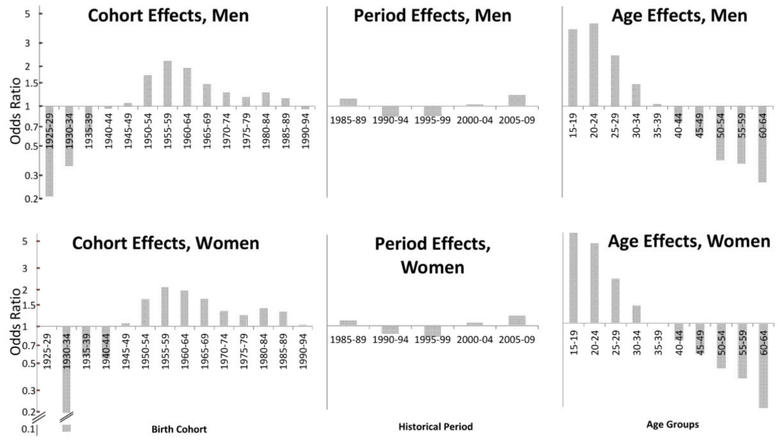

Figure 2.

Age, Period, and Cohort Effects for Past-Year Marijuana Use for Men and Women, All Race/Ethnicity Groups Combined

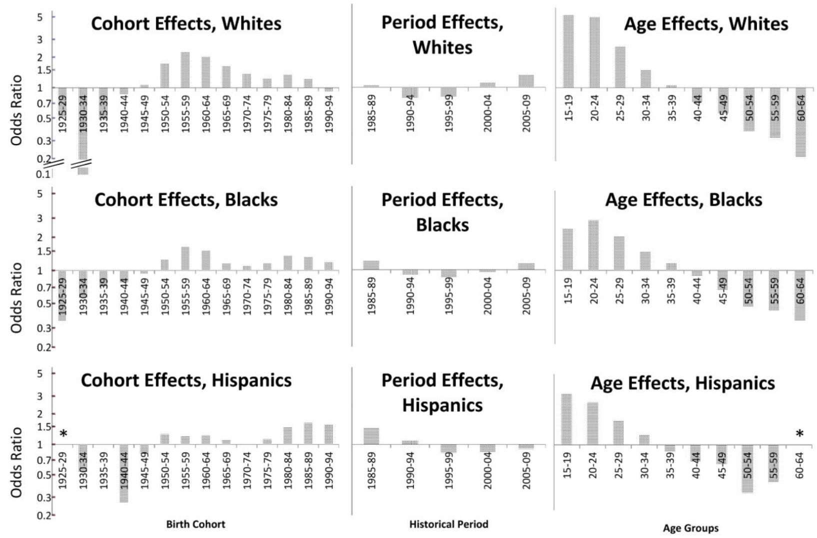

Figure 3.

Age, Period, and Cohort Effects for Past-Year Marijuana Use by Race and Ethnicity (continues)

* note: Analysis excludes Hispanics age 60–64 (and as a consequence not enough information is available to estimate effects for the 1925–29 birth cohort) because model would not converge when they were included in the analysis pool

Table 1

Results from Age-Period-Cohort Analysis of Past Year Marijuana Use: Unexponentiated Coefficients for Women and Men, 1985–2009 (95% Confidence Intervals in Parentheses), continues

Variable	Women (n=405,186)	Men (n=363,341)
Cohort		
1925–29	0.0101 (−1.56 – 1.58)	−1.56** (−2.67 – −0.454)
1930–34	−2.51** (−3.81 – −1.21)	−1.04** (−1.71 – −0.376)
1935–39	−0.56 (−1.29 – 0.167)	−0.488 (−1.04 – 0.0617)
1940–44	−0.605* (−1.14 – −0.0734)	−0.0521 (−0.428 – 0.324)
1945–49	0.0626 (−0.333 – 0.458)	0.0621 (−0.206 – 0.33)
1950–54	0.509** (0.185 – 0.833)	0.534** (0.31 – 0.758)
1955–59	0.742** (0.484 – 1)	0.788** (0.609 – 0.967)
1960–64	0.682** (0.489 – 0.874)	0.667** (0.529 – 0.805)
1965–69	0.517** (0.384 – 0.65)	0.387** (0.29 – 0.484)
1970–74	0.289** (0.211 – 0.366)	0.233** (0.173 – 0.293)
1975–79	0.213** (0.163 –0.263)	0.152** (0.11 – 0.194)
1980–84	0.35** (0.262 – 0.438)	0.234** (0.17 – 0.298)
1985–89	0.274** (0.128 – 0.421)	0.144** (0.0429 – 0.246)
1990–94	0.025 (−0.188 – 0.238)	−0.0559 (−0.204 – 0.0925)
Period		
1985–89	0.0998 (−0.0467 – 0.246)	0.136* (0.0272 – 0.245)
1990–94	−0.153** (−0.23 – −0.0758)	−0.186** (−0.246 – −0.126)
1995–99	−0.204** (−0.247 – −0.16)	−0.176** (−0.218 – −0.134)
2000–04	0.0615 (−0.00956 – 0.133)	0.0306 (−0.0205 – 0.0817)
2005–09	0.195** (0.0651 – 0.326)	0.195** (0.106 – 0.285)
Age		
15–19	1.74** (1.47 – 2.01)	1.35** (1.17 – 1.54)
20–24	1.53** (1.33 – 1.74)	1.45** (1.31 – 1.59)
25–29	0.853** (0.704 – 1)	0.885** (0.782 – 0.988)
30–34	0.335** (0.233 – 0.437)	0.391** (0.317 – 0.466)
35–39	−0.00273 (−0.101 – 0.0955)	0.0363 (−0.0423 – 0.115)
40–44	−0.321** (−0.436 – −0.206)	−0.3** (−0.388 – −0.211)
45–49	−0.584** (−0.74 – −0.428)	−0.524** (−0.647 – −0.401)
50–54	−0.862** (−1.1 – −0.629)	−0.952** (−1.11 – −0.79)
55–59	−1.06** (−1.34 – −0.779)	−1.01** (−1.21 – −0.807)
60–64	−1.63** (−2.03 – −1.23)	−1.33** (−1.59 – −1.07)
Constant	−3.16** (−3.35 – −2.97)	−2.46** (−2.59 – −2.33)

* $p<.05$

** $p<.01$

Table 2

Results from Age-Period-Cohort Analysis of Past Year Marijuana Use: Unexponentiated Coefficients by Race/Ethnicity, 1985–2009 (95% Confidence Intervals in Parentheses), continues

Variable	White (n=485,182)	Black (n= 112,243)	Hispanic† (n= 129,036)
Cohort			
1925–29	−0.661 (−1.96 – 0.633)	−1.05 (−2.61 – 0.513)	--
1930–34	−2.03** (−2.92 – −1.14)	−0.57 (−1.45 – 0.311)	−0.616 (−2.06 – 0.825)
1935–39	−0.716* (−1.35 – −0.084)	−0.339 (−0.957 – 0.278)	−0.018 (−0.806 – 0.77)
1940–44	−0.161 (−0.569 – 0.247)	−0.248 (−0.77 – 0.274)	−1.33** (−2.26 – −0.391)
1945–49	0.068 (−0.232 – 0.368)	−0.0617 (−0.46 – 0.337)	−0.222 (−0.81 – 0.365)
1950–54	0.546** (0.297 – 0.795)	0.225 (−0.108 – 0.558)	0.236 (−0.167 – 0.64)
1955–59	0.806** (0.607 – 1.01)	0.494** (0.235 – 0.753)	0.195 (−0.128 – 0.518)
1960–64	0.711** (0.56 – 0.862)	0.41** (0.211 – 0.609)	0.204 (−0.0399 – 0.448)
1965–69	0.492** (0.389 – 0.596)	0.143* (0.00191 – 0.284)	0.0963 (−0.0803 – 0.273)
1970–74	0.319** (0.258 – 0.379)	0.0898 (0.0000719 – 0.18)	−0.00225 (−0.121 – 0.117)
1975–79	0.212** (0.171 – 0.253)	0.157** (0.087 – 0.226)	0.118** (0.0357 – 0.201)
1980–84	0.298** (0.228 – 0.368)	0.3** (0.201 – 0.4)	0.387** (0.281 – 0.493)
1985–89	0.192** (0.077 – 0.307)	0.27** (0.114 – 0.425)	0.491** (0.329 – 0.654)
1990–94	−0.0751 (−0.242 – 0.0914)	0.181 (−0.0488 – 0.41)	0.456** (0.209 – 0.702)
Period			
1985–89	0.0479 (−0.0678 – 0.164)	0.193* (0.0421 – 0.345)	0.376** (0.206 – 0.546)
1990–94	−0.214** (−0.276 – −0.152)	−0.11* (−0.198 – −0.0218)	0.0873 (−0.0109 – 0.186)
1995–99	−0.195** (−0.233 – −0.157)	−0.163** (−0.22 – −0.105)	−0.189** (−0.261 – −0.118)
2000–04	0.1** (0.0446 – 0.155)	−0.0495 (−0.128 – 0.029)	−0.17** (−0.258 – −0.0821)
2005–09	0.261** (0.16 – 0.361)	0.129 (−0.00781 – 0.265)	−0.104 (−0.26 – 0.0522)
Age			
15–19	1.59** (1.37 – 1.8)	0.907** (0.653 – 1.16)	1.26** (1.01 – 1.51)
20–24	1.55** (1.39 – 1.71)	1.1** (0.904 – 1.29)	1.05** (0.865 – 1.24)
25–29	0.906** (0.787 – 1.02)	0.755** (0.609 – 0.9)	0.597** (0.455 – 0.74)
30–34	0.38** (0.299 – 0.461)	0.407** (0.294 – 0.519)	0.241** (0.112 – 0.369)
35–39	0.0464 (−0.0278 – 0.121)	0.164* (0.0386 – 0.29)	−0.165* (−0.329 – −0.00149)
40–44	−0.323** (−0.407 – −0.239)	−0.122 (−0.271 – 0.027)	−0.416** (−0.625 – −0.207)
45–49	−0.565** (−0.687 – −0.443)	−0.427** (−0.622 – −0.232)	−0.473** (−0.746 – −0.2)
50–54	−0.96** (−1.13 – −0.793)	−0.805** (−1.07 – −0.541)	−1.18** (−1.7 – −0.666)
55–59	−1.1** (−1.31 – −0.884)	−0.876** (−1.23 – −0.523)	−0.912** (−1.35 – −0.472)
60–64	−1.52** (−1.8 – −1.25)	−1.1** (−1.53 – −0.675)	--
Constant	−2.74** (−2.89 – −2.59)	−2.42** (−2.59 – −2.25)	−2.81** (−3.00 – −2.63)

* $p<.05$;

** $p<.01$

† Analysis excludes Hispanics age 60–64 (and as a consequence not enough information is available to estimate effects for the 1925–29 birth cohort) because the algorithm did not converge when they were included in the analysis pool