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Historical Change in the Link between Adolescent Deviance Proneness and Marijuana Use, 1979–2004

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Abstract

We examined historical change in the association between adolescent deviance proneness and marijuana use using 26 years (from 1979 through 2004) of national 12th grade data from the Monitoring the Future (MTF) study. “Deviance proneness” was measured using a latent factor model of behavioral and personality characteristics that underlie both substance use and antisocial disorders. Marijuana use outcomes were measured in terms of youths’ annual frequency of use, and youths’ degree of involvement with marijuana. Separate within-gender structural equation models were used to determine whether links between deviance proneness and marijuana use were consistently significant and invariant in magnitude across 13 2-year historical cohorts. Overall results affirmed the established association between adolescent deviance proneness and both the frequency of marijuana use as well as regular use. Among male youth, the size of the association between deviance proneness and marijuana use was significantly smaller at the cohort of lowest population prevalence (1991/92) compared to cohorts marking peaks in marijuana use prevalence, thus suggesting a “softening” historical trend. By contrast, the prediction of female marijuana use from deviance proneness was not consistently related to historical shifts in population prevalence of marijuana use. Study findings point to the utility of risk-focused prevention programming that targets early precursors of both antisocial and substance use disorders.

Keywords: Adolescent Marijuana Use, Historical Change, Deviance Proneness, Antisocial Behavior

Historical Change in the Link between Adolescent Deviance Proneness and Marijuana Use, 1979–2004
Marijuana has remained the most widely used illicit drug use among U.S. teens over the past quarter century, despite growing evidence that regular use of marijuana during adolescence is related to adolescent and adult mental health problems and curtailed educational attainment ([Fergusson, Horwood, & Ridder, 2005](#); [Fergusson, Horwood, & Swain-Campbell, 2002](#); [King, Meehan, Trim, & Chassin, 2006](#)). In this historical context, the first line approach to combat adolescent marijuana use has been widespread implementation of universal school-based drug use prevention programs ([Ringwalt & Greene, 1993](#)). However, despite proliferation of school-based prevention programs, national prevalence data do not reflect a stable decline in

adolescent marijuana use during the past quarter century. Rather, the prevalence of annual marijuana use among 12th grade adolescents declined from its highest level of 51% in 1979 to 22% in 1992, but rose again to another peak of 39% in 1997 and has declined minimally since then (34% in 2004) ([Johnston, O'Malley, & Bachman, 1996](#)). This trend in adolescent marijuana use has been similar within gender and most racial groups, although female adolescents report lower levels of marijuana use overall ([Wallace et al., 2003](#)).

Efforts to improve substance use prevention in the past two decades have focused on a “risk-focused” approach aimed at targeting the social and behavioral precursors of externalizing and substance use disorders ([Ennett, Tobler, Ringwalt, & Flewelling, 1994](#); [National Institute on Drug Abuse, 1997](#)). The wisdom of the risk-focused prevention approach is built upon a wealth of research establishing that adolescents who are most prone to use drugs regularly are also more deviance prone, as characterized by greater proclivities to defy social norms, participate in risky behaviors and show externalizing behavior problems ([Donovan & Jessor, 1985](#); [Krueger et al., 2002](#)). Prior research affirms that adolescent drug use and externalizing behavior problems have common personality antecedents ([Brook, Whiteman, Balka, Win, & Gursen, 1998](#); [Krueger, 1999](#)), often co-occur ([Derzon & Lipsey, 1999](#)), and share common functional and genetic variance ([Krueger et al., 2002](#); [McGee & Newcomb, 1992](#)). Moreover, deviance proneness has been linked prospectively to adult drug use problems and disorders; thus strengthening causal inferences of this risk association ([Hops, Andrews, Duncan, Duncan, & Tildesley, 2000](#)).

A clear public health advantage of targeting the precursors of externalizing disorders has been evinced by promising evaluations of risk-focused prevention programs ([Gottfredson & Wilson, 2003](#); [Tobler et al., 2000](#)). Programs designed to prevent externalizing morbidity have shown short and long-term efficacy (e.g., the Fast Track Program; [Bierman et al., 2007](#); [Conduct Problems Research Group, 2004](#) and the Incredible Years Intervention; [Reid, Webster-Stratton, & Hammond, 2003](#); [Scott, 2005](#)). Moreover, drug use prevention programs aimed at externalizing precursors have also shown promise in preventing drug use over the long-term. Examples of these include the Life Skills Program ([Botvin, Baker, Dusenberry, Botvin, & Diaz, 1995](#)) and the Guiding Good Choices Program ([Spoth, Redmond, Trudeau, & Shin, 2002](#)). Yet, despite promising efficacy findings, prevention scientists are currently challenged to retain treatment effectiveness of substance use prevention programs in the context of disseminating their programs on a larger-scale ([Ringwalt et al., 2002](#); [Tobler et al., 2000](#)).

A key stumbling block in large-scale dissemination of universal substance use prevention programs is establishing the effectiveness of prevention programs for all demographic subgroups (i.e. gender, ethnicity, and locale groups) ([Bierman et al., 2007](#); [Kumpfer, Alvarado, Smith, & Bellamy, 2002](#); [Spoth, Shin, Gyll, Redmond, & Azevedo, 2006](#)). Therefore, a critical question in effective dissemination of externalizing risk-focused substance use prevention programs is whether deviance proneness is a risk factor for marijuana use across all demographic groups at a population level. Thus, examining how deviance proneness affects patterns of drug use at a population level informs the utility of widespread dissemination of risk-focused prevention approaches ([Mrazek & Haggerty, 1994](#)).

This study represents an important contribution to our understanding of population-level associations between adolescent deviance proneness and marijuana use by examining historical moderation of this risk association using 26 years of historical cohort data (1979–2004). This historical perspective permits con-

sideration of whether deviance-risk for adolescent marijuana use has been consistent across historical cohorts. Establishing historical consistency in this risk association offers support for the reliability of risk-focused prevention programming at a population level.

From an historical perspective, the strength of association between deviance proneness and adolescent drug use is particularly affected by the changing psychosocial meaning of deviance and drug use behaviors over time. As the social meaning and corollary norm acceptance of behaviors like drug use change over time, the risk correlates of those behaviors change as well. As a result, there is a gradual shift in the deviance-proneness profiles of those who participate in drug using behaviors across historical cohorts ([Chassin, Presson, Morgan-Lopez, & Sherman, 2007](#)).

Building on prior historical research, the goal of this study was to examine whether the “typical” degree of deviance-proneness of adolescent marijuana users has notably changed across historical peaks and valleys in population prevalence of marijuana use during the past 26 years. These peaks and valleys in adolescent marijuana use are historically significant because they marked distinct shifts in adolescents’ norm acceptance of marijuana use from highest social approval and use in years 1979 and 1997/1999 to the lowest social approval and use in years 1991–1992 ([Bachman, Johnston, & O’Malley, 1998](#)). We thus expected there would be historical shifts in the deviance proneness of the population of marijuana users first between the 1979 peak in population use to the 1991/1992 historical low in prevalence and then again between 1991/1992 and the contemporary peak of marijuana use in 1997/1999.

Two potential historical shifts in deviance-prone characteristics of adolescent marijuana users were considered in this study. We first examined the potential for a hardening shift, which is represented by an increasing deviance-proneness of adolescent marijuana users during historical lows in the prevalence of use. Hardening shifts were first introduced in the adult smoking literature to characterize the current “hard core” treatment-resistant population of smokers who are more nicotine-dependent, less educated and more likely to have co-morbid psychiatric disorders than the general population of smokers had been when smoking prevalence was higher ([Irvin, Hendricks, & Brandon, 2003](#)). In the adolescent smoking population, this hardening shift has been more specifically framed with respect to the prevailing deviance-proneness of the population. For example, a hardening shift among adolescent smokers was revealed in [Chassin and colleagues’ \(2007\)](#) recent study showing that in the 2001 historical context of increasing public regulation and social disapproval of cigarette smoking, adolescent smokers were more likely to endorse deviance prone personality and behavioral characteristics than were adolescent smokers of 1980.

We also examined an equally plausible, but as yet unexplored historical shift in the deviance-profile of adolescent marijuana users, which we call “softening”. Softening refers to a decrease in deviance proneness of the population of marijuana users during times of historically low use and a corresponding rise in deviance proneness of marijuana users when prevalence rates are rising. We expected that this softening pattern of association between deviance-prone risk and marijuana use would be likely because the use of marijuana is affected not only by its social acceptability, but by illicit market control. Unlike cigarette smoking, therefore, public health control over adolescent marijuana use is determined in part by adolescent illicit market participation and criminal sanctioning for juvenile drug use. Related to this distinction, as adolescent acceptance and use of marijuana has risen since 1992, both the illicit availability of marijuana as well as adolescents level of involvement in illicit drug sales ([Library of Congress, 2003](#); [National Research Council &](#)

[Institute of Medicine, 2001](#)). As a result, studies since 1991 reflect that the most deviance-prone youth have been most likely to use marijuana at a high level owing to their illicit market participation ([Steinman, 2005](#)).

Hardening and softening shifts in the strength of the association between adolescent deviance proneness and marijuana use are distinguished by their implications for prevention programming. Hardening trends in the population of drug users suggest particular support for increased use of risk-focused approaches during times of low population prevalence given that the remaining population of “hardened” drug users would be more likely to exhibit deviance propensity. In addition, hardening trends lend support for use of universal programming and public health strategies to increase the social reprobation of drug use during times of high population prevalence when less deviance-prone youth are using the drug. Conversely, softening trends in a drug-using population highlight the utility of increased use of risk-focused approaches during times of higher population prevalence, when deviance-prone youth would be more likely to use drugs regularly. Further, softening trends would support use of universal public health strategies and criminal sanctions leading to the social reprobation of its use as well as reduced demand within illicit markets during both peaks and valleys in adolescent marijuana use.

Current Study Model

To date, only a handful of national historical cohort studies have compared links between risk factors related to older adolescents’ externalizing problems and marijuana use with data from the past three decades ([Bachman, O'Malley, & Johnston, 1986](#); [Brown, Schulenberg, Bachman, O'Malley, & Johnston, 2001](#)). The most recent historical study of correlates of 12th grade marijuana use relied on regression methods to compare the significance of links between a variety of risk factors and frequency of adolescent marijuana use between 1976 and 1997 ([Brown et al., 2001](#)). It is noteworthy that this study did not statistically compare the magnitude of associations between risk factors and marijuana use, and considered a limited scope of deviance-related risk factors (i.e. truancy and indices of low conventionality).

This current study extends prior historical research on risk correlates of late adolescent marijuana use in a number of ways. First, this is the first national historical cohort study to consider how links between deviance proneness and marijuana use during late adolescence are *moderated* by historical shifts in population prevalence of marijuana use. Within a structural equation modeling framework, we used a multiple-group cohort design to explicitly compare the strength of risk associations across population peaks and valleys of marijuana use.

We also strengthened our historical comparisons by using multiple operationalizations of adolescent marijuana use. In addition to considering the consistency of the strength of links between deviance proneness and frequency of annual marijuana use, we used two planned contrasts to determine the relation between deviance proneness and degree of marijuana use (i.e. no use, occasional use and regular marijuana use). In accord with prior research ([Shedler & Block, 1990](#); [Stice, Myers, & Brown, 1998](#)), we expected that deviance proneness would show a particularly strong association with regular marijuana use among users across historical cohorts. In addition, we examined whether youth who showed less problematic, occasional use patterns would show greater deviance propensity relative to non-users across historical cohorts given that prior research affords mixed support for this hypothesis ([Shedler & Block, 1990](#); [Tucker, Ellickson, Collins, & Klein, 2006](#)).

This study extends prior historical research by using a factor-analytic model of the theoretically and empirically-grounded construct of deviance proneness as a predictor of adolescent marijuana use. Our latent construct of deviance proneness was informed by not only earlier notions of problem behavior theory ([Donovan & Jessor, 1985](#); [McGee & Newcomb, 1992](#)), but more contemporary understanding of the “externalizing spectrum” ([Krueger et al., 2002](#)). Further, unlike prior historical studies, this study’s model of deviance proneness combined measures of conduct problems (i.e. criminal behavior and truancy) as well as measures of personality factors (i.e., low conventionality and sensation seeking) that have been shown to be prospectively related to adult marijuana use ([Brook, Brook, Arencibia-Mireles, Richter, & Whiteman, 2001](#); [Brook, Whiteman, Finch, & Cohen, 2000](#); [Horvath, Milich, Lynam, Leukefeld, & Clayton, 2004](#); [White, Labouvie, & Bates, 1994](#)) and to underlie the co-occurrence of adolescent antisocial behavior disorders and substance use disorders in recent genetic-factor analytic studies ([Krueger et al., 2002](#)). Adolescents’ commitment to conventional norms and behaviors is believed to serve as an important source of restraint from participating in aggressive and/or antisocial behaviors ([Krueger et al., 2002](#)). Sensation seeking, by contrast, motivates youths’ propensity to seek thrills through risky, antisocial acts. The wisdom of integrating consideration of both personality and behavioral factors in our measurement of deviance proneness is highlighted by successful efforts at reducing adolescent drug use by implementing public service announcements targeted at personality pre-cursors of adolescent drug use ([Stephenson, 2003](#)).

The current study is also distinguished by its use of a factor analytic approach to examine adolescent deviance proneness across the national historical context. Factor analytic methods offers several advantages such as providing a measurement-error free representation of deviance proneness, making explicit and testing the hypothesized measurement model for deviance proneness, and facilitating examination of the measurement invariance of deviance proneness over time ([Bollen, 1989](#)). The latter advantage is especially relevant and important for a historical-cohort study. Measurement invariance facilitates interpreting changes or consistency in the deviance-proneness and marijuana use relationships across historical cohorts by minimizing the possibility that these comparisons are confounded by any historical shifts in the meaning of deviance-proneness or psychometric properties (i.e., factorial validity and reliability) of its measurement.

Another contribution of the current study is that we consider how historical associations between adolescent deviance proneness and marijuana use vary as a function of gender. To date, prior historical studies have not examined within gender patterns of this risk relation. This is problematic because the literature suggests that gender groups vary with respect to predominant levels and patterns of adolescent antisocial behaviors ([Windle, 1990](#)), prevalence of marijuana use ([Wallace et al., 2003](#)) and the consistency of prospective associations between antisocial behavior indicators and marijuana use ([Mason & Windle, 2002](#); [Pedersen, Mastekaasa, & Wichstrom, 2001](#); [Windle, 1990](#)). Thus, within gender analyses will provide a more clear and comprehensive picture of associations between externalizing risk and marijuana use across historical contexts than combining gender groups.

Study Aims

The current study provides a rigorous, population level test of the association between adolescent propensity for deviance and their annual use of marijuana using 26 years of 12th grade data from the Monitoring the Future study (1979 – 2004). Our aim was to determine whether the well-established relation between adolescent deviance proneness and frequency of adolescent marijuana use has remained invariant during the past 26 years (1979 and 2004). Based on our reading of the literature, we expected that the association be-

tween deviance proneness and both the frequency of marijuana use as well as the likelihood of heavier use would be *significant* across time. In addition, we examined the potential for two historical trends in the strength of this relationship- “hardening” and “softening” (Chassin et al., 2007). The hardening hypothesis suggests that deviance proneness is a stronger predictor of adolescent marijuana use during times of historically low population use because marijuana use amongst the non-externalizing sub-population of youth declines, while the sub-population of deviance-prone youth continue to use. By contrast, “softening” trends are indicated when predictive associations between deviance proneness and marijuana use decreases during times of historically low population use, suggesting that deviance prone youth follow overall population trends in use of marijuana (or even show greater decline than overall trends) and that marijuana use becomes less concentrated within “deviance prone” subgroups of adolescents.

METHOD

The current study used national panel data from the Monitoring the Future (MTF) project, an ongoing annual nationally-representative survey of youth (Johnston, O'Malley, Bachman, & Schulenberg, 2005). Every year since 1975, the MTF project has sampled a nationally representative sample of between 15,000 and 19,000 high school seniors from approximately 135 randomly selected high schools in the coterminous 48 states. Multi-staged, clustered sampling was used to select high schools. More information on the sampling method and the larger MTF survey can be obtained from the study's website, <http://www.monitoringthefuture.org>.

Each respondent completed one of several randomly administered machine-readable Forms of the MTF survey during normal class periods. Between 75% and 80% of students sampled returned questionnaires between 1979 and 2004. Most non-responders were absent on the day of administration.

Sampling

The sub-sample for the current study ($N = 44,751$) was selected from all participants who had completed Form 2 of the MTF survey and whose race/ethnicity and gender information was available in the public dataset ($N = 60,093$). Limitations of the study sampling of African-American participants impeded adequate sampling for valid measurement of the deviance proneness factor.¹ Therefore, Form 2 data on African-American participants ($N = 9,079$, 15% of 60,093) were excluded from final study analyses. Another 10% of the Form 2 sample ($N = 6,263$) representing 12% of the European-American sub-sample was not included in final analyses because of insufficient data. Thus, the final sub-sample consisted entirely of non-minority European-American participants, representing 74.5% of Form 2 participants with identified gender and ethnicity information and 88% of the European-American sub-sample.

We divided the sample into 13 2-year cohorts beginning with 1979–1980 through 2003–04 to facilitate historical comparisons. Each 2-year cohort consisted of data from between 2,586 and 4,538 participants. Separate analyses by gender reduced the size of cohorts to between 1,191 and 2,453 participants for males and 1,195 and 2,250 for females.

The current sample was approximately 50.5% female. Nearly one-fifth (16.7%) of participants reported living in a household headed by a single parent, 79.2% reported living in a two-parent household, while 4.1% reported having no parents in the household. On average, participants reported that their parents had completed high school and taken some college courses; nearly half (46.3%) of participants reported that their parents had completed a college or graduate degree. Roughly half (44.4%) of participants reported living in an urban area.

Measures

Detailed item and scale descriptions for all study measures are summarized in [Table 1](#). *Annual marijuana use* was measured with a single item on a 7- point scale. Across waves, 48.1% (1979) to 75.8% (1991) reported abstaining from any past year marijuana use, and the average level of marijuana use was roughly 3–5 times in the past year across all cohorts, although this varied with cohort. A trichotomous marijuana use variable was derived from annual marijuana use frequency, representing *No Use* (average proportion across cohorts, 61.1%), *Occasional Use* (up to 3 times per month, average proportion across cohorts, 29.9 %) and *Regular Use* (more than 3 times a month, average proportion across cohorts, 9%).

Table 1

Measures	Description
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Measure and Item Description	Response Anchors		
Outcome: Annual Marijuana Use			
1. Frequency of marijuana use: “On how many occasions (if any) have you used marijuana or hashish during the last 12 months?”	(0) 0 occasions	(1) 1–2x	(2) 3–5x
	(3) 6–9x	(4) 10–19x	(5) 20–39x
	(6) 40+ occasions		
2. No marijuana use/Occasional marijuana use/Regular marijuana use	(0) 0 occasions	(1) Between 1–2x and 20–39x	
	(2) 40+ occasions		
Deviance proneness: Second-order CFA			
1. Conduct Problems: First-order factor			
Criminal behavior: 8 items measuring frequency of theft (3 items), property damage (2 items) and aggression (3 items)	(1) not at all	(2) once	(3) twice
		(4) 3–4 times	(5) 5+ times
(Ex.) “During the last 12 months, how often have you taken something from a store without paying for it?”			
Truancy: 2 items	(1) none skipped	(2) 1 day	(3) 2 days
(Ex.) “During the last four weeks how many whole days of school have you missed because you skipped or “cut”?”	(4) 3 days	(5) 4–5 days	
	(6) 6–10 days		
2. Conventionality: First-order factor			
Religious commitment: 2 items “How important has religion been in your life?” and “How often do you attend religious	(1) not important through		
“How important has religion been in your life?” and “How often do you attend religious services?”	(4) very important		
	(1) never through	(4) weekly or more	

A second-order factor model of *deviance proneness* was measured consisting of three first-order factors: conduct problems (one criminal behavior factor score and two truancy items), thrill seeking (two items) and conventionality (three items). First order factors were selected from factor analytic studies examining the personality and behavioral characteristics underlying the co-occurrence of antisocial and substance use disorders in adolescence and adulthood ([Donovan & Jessor, 1985](#); [Krueger et al., 2002](#); [McGee & Newcomb, 1992](#)). The criminal behavior factor score was derived from a preliminary confirmatory factor analy-

ses of eight criminal behavior items. Using a criminal behavior factor score permitted reduction of eight ordered categorical variables to a single continuous factor score. This strategy improved efficient estimation of the second order deviance proneness factor.

Urbanicity, parental education and number of parents in the household were used as covariates in all predictive models (see [Table 1](#)).

Analytic Strategy

We began with preliminary analyses to establish the proper measurement model for the criminal behavior factor. An ordinal confirmatory factor model was used to characterize the relationships between the criminal behavior latent factor and its ordered-categorical indicators ([Flora & Curran, 2004](#)). As our intention was to compare structural relationships between cohorts, we tested whether the same factor pattern held across all cohorts and whether factor loadings were invariant across cohorts. Establishing measurement invariance allows more confidence that cohort differences in structural path estimates represent real cohort differences and are not artifacts of differing measurement properties across cohorts ([Meredith, 1993](#)). Factor scores were then used as an indicator in the deviance proneness factor model.

Analyses were then conducted to establish the deviance proneness factor model. Single-item indicators of this model were less affected by floor-effects in comparison to the criminal behavior items; therefore, a continuous-variable factor model with a robust estimator to address non-normality was used. Across-cohort measurement invariance analyses were then conducted.

Linear and nonlinear relationships between the deviance proneness factor and marijuana use were explored using two different structural equation models. A latent factor two-part (semi-continuous) regression model was used to simultaneously estimate the relationships of deviance proneness with any marijuana use (vs. no use) and frequency of marijuana use, given some use ([Duan, Manning Jr., Morris, & Newhouse, 1983](#)). However, only the relationship between deviance proneness and frequency of marijuana was of interest for this study. One advantage of this model is that it is better equipped to handle the distribution of marijuana use, which has many non-users. In addition, we used a multinomial logistic model to explore whether deviance proneness corresponded with a greater probability of regular marijuana use (vs. occasional use) and with a greater probability of occasional marijuana use (vs. no use). Likelihood ratio tests were used to assess whether the relationships between deviance proneness and marijuana use outcomes were equal between select cohorts. For both models, we statistically controlled for urbanicity, parental education, and number of parents in the household.

All factor and structural equation model analyses were conducted using Mplus software ([Muthén & Muthén, 2006](#)). Analyses were conducted separately by gender and were weighted to account for unequal selection probabilities. A robust weighted least squares estimator was used for the criminal behavior factor analyses, whereas robust full information maximum likelihood estimation was used for all other analyses. Use of robust estimation procedures facilitates the most accurate estimation of standard errors in the presence of non-normally distributed data ([Yuan & Bentler, 1998](#)). Full information maximum likelihood estimation provides efficient and unbiased parameter estimates in the presence of missing data under missing at random conditions ([Schafer & Graham, 2002](#)). Model fit was evaluated using the chi-square test of exact fit and approximate fit indices.

RESULTS

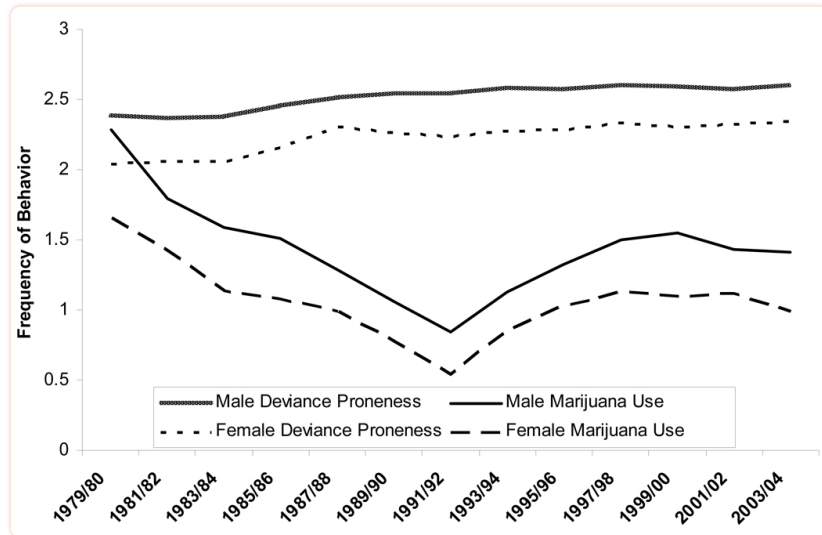
Preliminary Measurement Analyses

The criminal behavioral factor model fit the data acceptably well across cohorts [$\chi^2(119) = 218.56, p < .001$, RMSEA = .022, CFI = .997 and $\chi^2(144) = 176.53, p = .03$, RMSEA = .011, CFI = .999, for male and female models, respectively]. Items were salient indicators of the criminal behavior construct; standardized factor loadings ranged between .38 and .83. Likelihood ratio tests rejected the tenability of full across-cohort invariance of factor loadings [$\chi^2(72) = 167.06, p < .001$ and $\chi^2(69) = 102.11, p = .006$, for male and female models, respectively]. However, our large sample sizes are likely to result in trivial cohort differences becoming statistically significant. Therefore, we examined the change in comparative fit index (Δ CFI) values between constrained (loadings invariant) and unconstrained (loadings variant) models, with values greater than $-.01$ leading to rejection of the invariance constraints (Cheung & Rensvold, 2002). For both male and female analyses, Δ CFI were smaller than .005, thereby supporting the acceptance of the factor loading invariant models.

Deviance Proneness Factor Model

Results indicated that the deviance proneness factor model fit the data acceptably well across cohorts for both males and females [$\chi^2(182) = 309.17, p < .001$, RMSEA = .020, CFI = .994 and $\chi^2(184) = 272.74, p < .001$, RMSEA = .016, CFI = .997, respectively]. Factor loadings were substantial, with many exceeding .70. Although the likelihood ratio test rejected the factor loading invariance model [$\chi^2(86) = 114.78, p = .02$ and $\chi^2(90) = 160.20, p < .001$, for male and female models, respectively], the invariance constraints can be considered approximately valid (Δ CFIs were smaller than $-.005$) and sufficient for making valid across-cohort comparisons of the deviance proneness and marijuana use relationship. *Historical Trends in Deviance Proneness and Frequency of Annual Marijuana Use*

[Figure 1](#) contains plots of the frequency of deviance proneness and of marijuana use across cohorts for each gender. Reports of deviance proneness remained relatively constant between 1979 and 2004, with levels consistently higher for males. By contrast, population frequency of marijuana use showed marked variability across cohorts. The highest frequency of marijuana use was at 1979/80, from which rates steadily decreased to the lowest historical levels at 1991/92, increased steadily until 1997, and decreased slightly since 1999/00. On average, males showed a higher frequency of marijuana use than females.



[Figure 1](#)

Historical trends in male and female youths' frequency of annual marijuana use and deviance proneness.

Historical Change in Links between Deviance Proneness and Frequency of Marijuana Use

Controlling for parental education, number of parents in the household, and urbanicity, deviance proneness was significantly associated with greater annual frequency of marijuana use across all cohorts and for each gender (see comparison of structural regression coefficients in [Figure 2](#)). The consistency of this relationship, however, was accompanied by pronounced variability in its strength across cohorts. Among male youth, the historical trend in this relationship resembled the historical trend in frequency of marijuana use. That is, the relationship was relatively strong at 1979/80, progressively weakened (except for a positive spike at 1985/86) to its historically weakest point at 1991/92 and then showed a monotonically increasing trend (except for a negative spike at 2001/02) to its historically highest point at 2003/04.

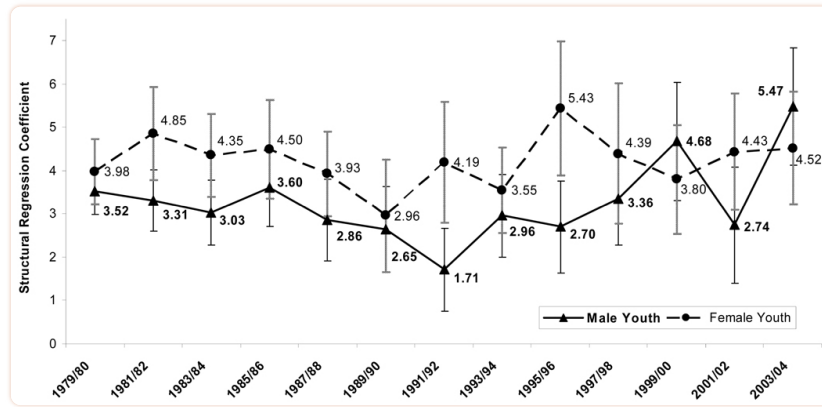


Figure 2

Historical trends in the linear relationship between deviance proneness and annual frequency of marijuana use for male and female youth.

We conducted a series of planned tests of the equivalence of this relationship between selected cohorts derived from our hypotheses. Consistent with the softening hypothesis, the magnitude of this relationship was significantly weaker at 1991/92, when population marijuana use was at its historical lowest, relative to when population marijuana use levels are highest at 1979/80 [$\chi^2(1) = 11.19, p = .001$], 1997/98 [$\chi^2(1) = 5.97, p = .02$], and 1999/00 [$\chi^2(1) = 27.81, p < .001$]. However, although population marijuana use has remained relatively constant since 1997/98, the relationship between deviance proneness and frequency of marijuana use increases and is at its strongest at 2003/04. In a comparison between these two cohorts to provide a contemporary point of reference, results indicated that the relationship was significantly stronger for the most recent cohort [$\chi^2(1) = 10.62, p = .001$].

The observed historical pattern for the relationship between deviance proneness and frequency of marijuana use for females did not track the historical trend in population marijuana use. In fact, for female youth, a prominent peak at 1995/96 (historical highest point) and dip at 1989/90 (historical low) in the magnitude of this relationship manifests earlier than for male youth. With the exception of those cohorts, this relationship remained relatively constant over time. Of the tests conducted, the only difference that reached statistical significance was that between 1989/90 and 1995/96 [$\chi^2(1) = 7.13, p = .008$]. The difference between the cohorts exhibiting the highest and lowest population marijuana use (1979/80 and 1991/92) was not statistically significant, thus supporting invariance in the relationship during times of low and high population use. In addition, contrary to results for male adolescents, the relationship was numerically stronger at 1991/92 than at 1979/80.

Historical Change in the Relation of Deviance Proneness to Degree of Marijuana Involvement: Multinomial Logistic Model Results

Occasional use vs. no use The deviance proneness factor was also predictive of greater odds of occasional use relative to the odds of no use (see [Figure 3–Figure 4](#)). This relationship was consistently significant across cohorts and gender, but some variability in its strength was observed and different patterns emerged

between males and females. For male youth, the relationship between deviance proneness and probability of occasional use was significantly higher at 1999/00 than at 1991/92 when marijuana use was least normative, [$\chi^2(1) = 16.56, p < .001$], thus reflecting a softening trend. However, this relationship did not appear to vary substantially in magnitude between cohorts 1979 to 1998, and none of planned comparisons involving cohorts within this range were statistically significant.

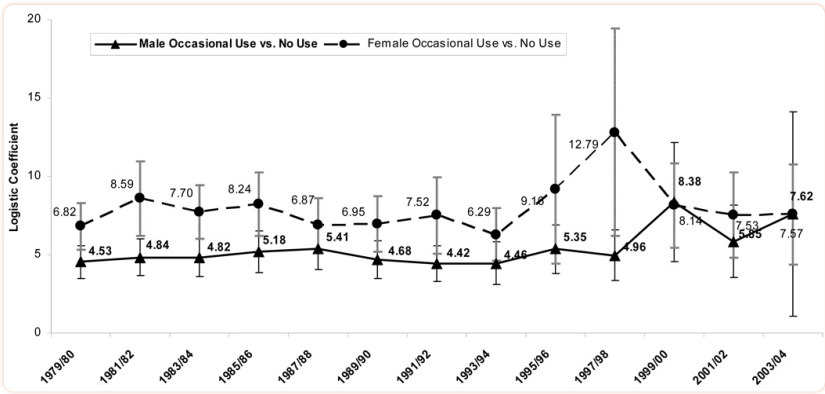


Figure 3

Historical trends in the relationship between adolescent deviance proneness and degree of marijuana involvement: Probability of occasional marijuana use versus no marijuana use in male and female youth.

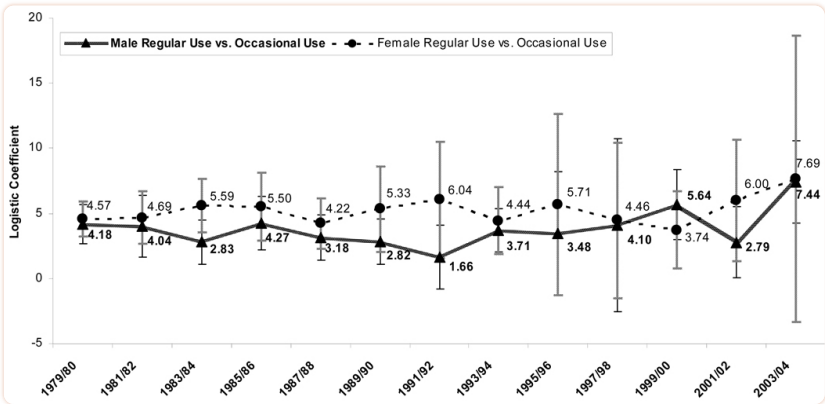


Figure 4

Historical trends in the relationship between adolescent deviance proneness and degree of marijuana involvement: Probability of regular marijuana use versus occasional marijuana use in male and female youth.

In general, deviance proneness was a stronger predictor of occasional marijuana use among females than among males, but the relationship did not track trends in population use. This relationship was numerically strongest for girls at 1997/98 and weakest at 1993/94. Only the comparison between 1997/98 and 2003/04 cohorts [$\chi^2(1) = 44.99, p < .001$] was significant.

Regular use vs. occasional use Deviance proneness was a significant predictor of male youths' regular marijuana use for all but the two most recent cohorts (2001/02 and 2003/04). However, standard errors were especially large for these cohorts, and therefore, the significance test should be viewed with caution.² The historical pattern in this association reflected a softening trend. That is, the strength of this relationship declined to its lowest point at 1991/92, when population marijuana use was at its lowest, and then increased in subsequent cohorts. Statistically, the relationship was weakest at 1991/92 in comparison with cohorts at 1979/80 [$\chi^2(1) = 17.78, p < .001$] and 1999/00 [$\chi^2(1) = 5.63, p = .02$]. The difference in the relationship between 1991/92 and 2003/04 was marginally non-significant [$\chi^2(1) = 3.26, p = .07$].

Among females, most cohorts exhibited a significant relationship between externalizing and regular marijuana use. A significant relationship was not observed at 1995/96, 1997/98, and 2003/04. As was observed for male youth, the standard errors for these cohorts were especially large, thus warranting caution in interpretation.² The overall trend in this relationship across cohorts did not map onto the historical trend for marijuana use as it did for male youth. In fact, this relationship was relatively stronger (numerically) at 1991/92 when population marijuana use is lowest, and was relatively weaker at 1979/80 and in the late 1990s when population marijuana use was at historically high levels; thus suggesting a hardening trend. However, none of the tests comparing this relationship across cohorts was significant.

Covariate Effects

The impact of covariates on adolescent marijuana use was more variable than the impact of deviance proneness on adolescent marijuana use across cohorts and gender. Among male youth, urbanicity was predictive of both a greater frequency of marijuana use ($b = 0.26$) and of a higher probability of being a regular user relative to an occasional user ($b = 0.19$) each for only a single cohort. This covariate was also predictive of greater probability of being an occasional user relative to a nonuser for five cohorts (range $b = 0.11 - 0.22$). For female youth, urbanicity was predictive of *less* marijuana use for a single cohort ($b = -0.27$). Similarly, parental education was infrequently related to greater marijuana use for both males (three cohorts; range $b = 0.19 - 0.28$) and females (five cohorts; range $b = 0.15 - 0.30$). In one exception (1979/80), parental education was related to *lower* frequency of marijuana use ($b = -0.09$) among female users. Finally, two-parent household status was predictive of less frequency of marijuana use and lower probabilities of regular and occasional use across a minority of the cohorts (males: seven cohorts, range $b = 0.32 - 0.55$; females: four cohorts, range $b = 0.27 - 0.42$).

DISCUSSION

Although a large body of research has affirmed that adolescents' deviance proneness is related to their frequency of marijuana use in selected samples, this is the first study to establish this relationship across 26 years of national historical data for both male and female youth. Results also affirmed that adolescents' deviance proneness is an important risk factor for all levels of adolescent marijuana use. That is, deviance proneness has been a consistent predictor of adolescents' occasional marijuana use (as compared to no use), and adolescents' regular marijuana use (versus occasional use) across time and gender. These results thus affirm that adolescents' deviance proneness is not only related to regular, more problematic use of marijuana but is also related to occasional use of marijuana, thus disconfirming prior suggestions that only regular use of marijuana is associated with a deviant behavioral profile ([Shedler & Block, 1990](#)).

Perhaps the most intriguing finding of this study was that the magnitude of the association between deviance proneness and frequency of marijuana use showed distinct historical trends for male versus female adolescents. Amongst male youth, this association reflected a softening trend with deviance proneness showing a smaller association with frequency of marijuana use and the probability of regular use (vs. occasional use) when population use was lowest (1991/92) than during historical peaks. These results suggest that during times of low population use of marijuana, male youth who are most deviance prone are more likely to *limit* their use of marijuana than during historical peaks in adolescent marijuana use, thus supporting the notion that male externalizers are *not* immune to prevailing negative social norms concerning marijuana use.

By contrast to male adolescent results, links between female youths' deviance proneness and both their frequency of annual marijuana use as well as the probability of their regular use were generally invariant across cohorts, with neither a hardening nor softening trend was supported. In fact, female results suggested instability in links between deviance proneness and frequency of marijuana use from the late 1980's and through the 1990's. Specifically, this association was smallest in 1989–90 just *prior* to the population valley in use (1991/92) and showed a significant increase in the mid-90's (1995/96). Yet, the size of this association for females at the absolute lowest population prevalence point (1991/92) was nearly identical to the size of the association at the population peak (1997/98). Similarly, links between female deviance proneness and the likelihood of both occasional and regular marijuana use was invariant across the historical highs and lows in population prevalence. This pattern of findings highlights the salience of deviance proneness as a risk factor for female adolescents' marijuana use regardless of historical shifts in the prevalence of marijuana use. Further, this historical pattern of shifts in links between deviance proneness and frequency of marijuana use suggests that neither “hardening” nor “softening” hypotheses can adequately explain changes in the predominant risk-characteristics of female marijuana users across time.

Another interesting finding from this study is that some *recent* historical trends in the magnitude of the deviance proneness – marijuana use relationship cannot be fully explained in terms of prevailing notions of “hardening” or “softening” across either gender. For example, the size of the association between deviance proneness and the likelihood of regular marijuana use for all participants, as well as the size of the association between male deviance proneness and frequency of use was greatest at 2003–04, although marijuana use was decreasing at that historical point. In addition, there was a substantial short-term spike in the size of the association between deviance proneness and the probability of occasional marijuana use during the late 1990's (1997/98 for females and 1999/00 for males), although there was predominant stability in this relationship prior to these spikes across both genders.

These recent spikes in the prediction of level of adolescent marijuana use from adolescent deviance proneness may have been related to a number of converging historical trends in the availability of marijuana on the illicit market, as well as youths' participation in illicit drug markets. By one objective indicator - federal marijuana seizures- the illicit marijuana market has been booming in recent years – showing a rise of more than 4.5 times between 1991 (499,097 pounds) and 2002 (2,412,365 pounds) ([Library of Congress, 2003](#)). At the same time, the rate of drug related arrests amongst youth has also risen substantially, and studies have shown that youth who have participated in illicit drug and property markets have been most likely to use marijuana and other drugs most frequently ([Steinman, 2005](#)).

This study contributes to current discussion in the literature on historical moderation of links between adolescent externalizing risk and marijuana use in four important ways. First, by using an integrative latent factor model of deviance proneness, we have extended prior research considering links between adolescent problem behaviors and marijuana use in an historical framework. Our latent factor model integrated indicators of conduct problems (i.e. criminal behavior), conventionality and sensation seeking, thus providing a more comprehensive measurement of deviance proneness than has been considered in prior historical survey studies ([Bachman et al., 1986](#); [Brown et al., 2001](#)). Second, we used preliminary measurement invariance tests to establish the validity of the externalizing factor model across historical cohorts. Third, we used statistical tests to examine differences in the magnitude of associations between deviance proneness and frequency of marijuana use, rather than relying solely on the observation of patterns of significance. This strengthened the inferences we could draw from our results regarding historical moderation. Finally, using within-gender models contributed to our understanding of gender differences in this established risk-relationship across historical cohorts.

Contrary to current suggestion in the literature on tobacco use our results generally do not support hardening trends in adolescent marijuana use ([Chassin et al., 2007](#)). Because there is limited empirical evidence on hardening, it is difficult to draw conclusions from these differing findings. However, there are several distinctions between this study and prior research on tobacco use that may have contributed to differences in findings. First, given that marijuana itself an illegal drug, the use of marijuana by definition requires breaking a law. Thus, marijuana use may always be more linked to externalizing behavior because externalizing adolescents would always be more likely to participate in criminal behavior. By contrast, tobacco is a legal substance, and the characteristics of tobacco users might thus be more likely to vary in response to changes in population prevalence of smoking. In addition, our study focus on 12th graders may have influenced our detection of hardening effects. Prior tobacco research in the hardening of tobacco use has established hardening in middle school, rather than high school cohorts ([Chassin et al., 2007](#)). It may be that social norms about drug use may be most influential on use at ages of initiation into drug use, rather than amongst older adolescents.

The most notable limitation of this study is that minority youth were not included in the analyses, and therefore, results are not generalizable to minority youth. In addition, as a school-based study of 12th graders, youth who had dropped out before the 12th grade were not represented in the study, and therefore, some of the highest risk, deviance prone youth were under-represented in the study ([Swaim, Beauvais, Chavez, & Oetting, 1997](#)). Further, only older adolescents were represented, and birth cohort effects on use of marijuana and patterns of other drug use were not considered. Future research examining the historical moderation of links between adolescent deviance proneness and frequency of marijuana use will ideally include representative samples of minority adolescents and multiple adolescent age groups in order to extend the generalizability of study findings.

Another limitation of this study's design was that it did not consider adolescents' use of other illicit drugs as an outcome measure. Our findings suggesting that male deviance-prone youths limit their consumption of marijuana during periods of low consumption in the population does not preclude their increased consumption of other drugs during the same periods. Therefore, future research evaluating historical trends in links between adolescents' deviance proneness and their use of both marijuana and other illicit drugs would further elucidate the impact of population trends in drug use on adolescents' drug use in general.

Our use of adolescent self-reports of drug use raises the potential that our measurement of marijuana use lacked some accuracy as a result of situational and social desirability biases ([Harrison, 1997](#)). However, recent evaluations of the validity and reliability of MTF measures suggest that MTF drug use reports show high levels of test-re-test reliability, construct validity and predictive validity ([Harrison, 1997](#)). On a related note, questions have been raised regarding the degree to which MTF substance use data conform to findings of other epidemiological surveys ([Gfroerer, Wright, & Kopstein, 1997](#)). For this reason, follow-up attempts to cross-validate the current study's findings would prove useful.

Findings of this study suggest some directions for future research. It would be ideal to combine both longitudinal and historical cohort data to strengthen inferences that externalizing risk is related to the development of substance use and substance use problems across historical cohorts. For example, linking prior year externalizing risk factors with subsequent year marijuana use as well as marijuana use problems/disorders using multiple historical cohorts would improve confidence in our causal inferences.

Implications for Prevention Science

The stability of significant predictive associations between deviance proneness and the frequency of adolescent marijuana use across gender points to the utility and reliability of risk-focused substance use prevention approaches at a population level. In addition, the predominant invariance of historical associations between deviance proneness and both the frequency of use and regular use of marijuana use among female adolescents suggests that risk-focused prevention approaches would be especially effective in the prevention of female substance use problems. Moreover, the historical consistency of associations between deviance proneness and more problematic, regular use of marijuana provides particular support for use of risk-focused approaches to forestall the development of serious adult substance use and antisocial disorders at a population-level.

The softening trend in the strength of deviance proneness and marijuana use links among male youth since 1992 highlights the value of increased dissemination of risk-focused prevention and public health strategies to reducing adolescent marijuana use. Given that the association between deviance proneness and adolescent marijuana use has risen since 1992, wider dissemination of risk focused prevention strategies targeting externalizing precursors of substance use and substance use problems would increase the effective prevention of adolescent substance use. In addition, given that historical softening trends suggest that deviance-prone male youth were less likely to use marijuana when social disapproval of its use was highest, consistent use of prevention and public health efforts to increase social reprobation of marijuana use in the general population would have the collateral benefit of reducing marijuana use in the highest-risk male adolescent groups. For example, softening trends highlight the wisdom of strictly enforcing criminal sanctions for sale of illicit drugs to minors in order to enhance the social reprobation of adolescent marijuana use. Further, softening trends suggest that public service announcements targeted for deviance prone youth are a particularly useful prevention tool because they are designed to increase deviance-prone youths' awareness of the social and physical dangers of drug use ([Stephenson, 2003](#)). Finally, softening trends indicate that multi-component substance use prevention programs may be particularly effective if implemented on a wide scale. Specifically, risk-focused substance use prevention programs that integrate multiple individual, family, school and community components not only effectively address externalizing precursors of drug use, but also reduce youths' social approval and access to illicit drugs within the community, thus serving a dual prevention purpose ([U.S. Department of Education, 2001](#)).

It is noteworthy that the strength of associations between deviance proneness and male adolescent marijuana use has shifted considerably across historical peaks and valleys during the past two decades, although the underlying causes of these trends are not well-understood. Continued careful tracking of potential hardening and softening trends in the strength of this risk association would undoubtedly contribute to high-quality monitoring of the relative effectiveness of national prevention programming.

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Footnotes

¹Confirmatory factor analyses of the deviance proneness factor (separately by gender) revealed that this factor structure could not be adequately modeled for African Americans given the relatively low numbers of African American participants for each within gender cohort (average $N=173$ at each cohort each for male and female African Americans). In addition, results of analyses using African American participants were viewed with caution because of an under-sampling of African Americans relative to the national representation of African Americans in US schools <http://www.monitoringthefuture.org/>.

²Logistic coefficients for 2001/02 and 2003/2004 of male results as well as coefficients for 1995/96, 1997/98 and 2003/04 of female results were not significant, but large. This inconsistency may have been related to near “perfect separation” on outcome groups, which occurs when outcome groups are almost perfectly predicted by a set of predictors and results in the inflation of standard error values. This is more likely to happen when certain outcome categories have low frequencies.

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