A Discrete-Time Survival Analysis of the Relationship Between Truancy and the Onset of Marijuana Use*

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ABSTRACT. Objective: Despite truancy being a common behavior among teenagers, little research has assessed its deleterious effects. In this study, the effect of truancy on the initiation of marijuana use was examined. **Method:** Using data from the Rochester Youth Development Study (a longitudinal sample of predominantly minority youth), discrete-time survival analyses were estimated to assess the effect of truancy on the subsequent initiation of marijuana use. The current analyses used 5 years of panel data collected from youth and their primary caregiver every 6 months throughout adolescence. **Results:** Truancy was a significant predictor of the initiation of marijuana use during each subsequent 6-month period. The effect was more robust in earlier compared with later adolescence. These effects persisted after controlling for potential risk factors that are shared by both truancy and drug use, including commitment to school, grade-point average, delinquent values, prior involvement in delinquency, peer reactions to delinquency, parental monitoring, affective ties to the child, and positive parenting. **Conclusions:** We argue that the effect is, in part, the result of reduced social control (i.e., disengagement from pro-social entities such as school) and, in part, the result of the unsupervised, unmonitored time afforded by truancy. Prevention initiatives aimed at reducing truancy also may have a beneficial impact on preventing the initiation of drug use among adolescents. (*J. Stud. Alcohol Drugs* **70:** 5-15, 2009)

TRUANCY IS A SERIOUS CONCERN that affects most school districts in the United States. In a 2003 national survey of adolescents in the United States, 11% of 8th-grade students, 16% of 10th-grade students, and 35% of 12th-grade students reported skipping 1 or more days of school during the previous 30 days (Henry, 2007). Chronic or habitual truancy is especially prevalent in urban communities. For example, during the 2006-2007 school year, 9% of all public school students in Baltimore were deemed habitually truant (i.e., they were illegally absent on 20% or more of the school days) (Sundius and Farneth, 2008). In Wisconsin, habitual truancy is defined as accumulating five or more illegal absences in one semester. During the 2005-2006 school year, 45% of all public school students in Milwaukee met this criterion (Richards, 2006).

In addition to being a relatively common behavior, truancy is correlated with many negative consequences at multiple levels of society (Fantuzzo et al., 2005). Truant youth are more likely to perform poorly in school and drop out of school (Wehlage and Rutter, 1986), use illegal drugs (Henry and Huizinga, 2007; Miller and Plant, 1999), commit crimes (Baker, 2000; Bell et al., 1994; Garry, 1996; Huizinga et al., 1995; McAra, 2004), and become pregnant as a teenager (Hibbett and Fogelman, 1990). Truancy is also associated with poor adult outcomes, including violence, marital instability, job instability, lower-status jobs, adult criminality, and incarceration (Catalano et al., 1998; Hibbett and Fogelman, 1990; Hibbett et al., 1990). Moreover, the ill effects of truancy expand beyond the individual. For example, truancy has an indirect negative effect on communities; when more people within a community engage in problem behaviors and express negative adult outcomes (e.g., incarceration, job instability, etc.), the community as a whole suffers (Baker et al., 2001).

Despite truancy's prevalence and association with many negative outcomes, few studies have examined the consequences of truant behavior using longitudinal data and carefully controlling for potential confounders. The studies cited previously provide a foundation for identifying truancy as a potential risk factor or stepping-stone to further problem behavior, but, for a variety of reasons, they do not go beyond that. First, the temporal order of the link between truancy and problem behaviors during adolescence is typically not established. Second, because truancy is hypothesized to have a proximal effect on problem behavior, a short lag time between longitudinal assessments is needed to assess fully the impact of truancy. Third, prior research has not typically

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controlled for shared risk factors that are likely to impact both truancy and its potential consequences.

In this article, we add to the current work in this area by focusing on the impact of truancy on the onset of marijuana use. This is a relevant potential consequence of truancy to examine because 42% of marijuana users initiate use between the ages of 12 and 15 years (Substance Abuse and Mental Health Services Administration, 2001), and those who do are more likely to experience both short-term and long-term negative outcomes. For example, adolescent marijuana users are more likely than nonusers to drop out of high school, engage in HIV risk behaviors, and exhibit other forms of delinquency (Brook et al., 1999). They are also more likely to be arrested (National Institute on Drug Abuse, 2002) and use other illegal drugs such as cocaine, crack, and heroin (Ellickson et al., 1992; Kandel et al., 1992; Substance Abuse and Mental Health Services Administration, 2001). Marijuana use among adolescents is a serious public health concern, and further research to understand the conditions under which adolescents start using marijuana is necessary in order to implement initiatives to prevent or at least delay initiation.

In this study, we examined 6-month lags between truancy and initiation of marijuana use through the use of discrete-time survival analysis. By focusing on the initiation or onset of use following episodes of truancy, we were able to establish more clearly whether truancy is, in fact, a risk factor for marijuana use. That is, only truancy that occurred *before* the onset of marijuana use was able to contribute to the effect. Once initiation of marijuana use occurs, it is quite possible that truancy and marijuana use have a reciprocal relationship, confounding our ability to examine whether truancy is in fact a risk factor or "stepping-stone" for later problem behaviors such as marijuana use, as many have claimed. By focusing on the relationship between truancy and the subsequent initiation of marijuana use, we provide a more precise test of this hypothesis. In addition, we included more comprehensive measures of potential confounders than has typically been done in previous research. In particular we included both time-dependent and time-independent confounders in several developmental domains, including school engagement, personal involvement in delinquency and endorsement of delinquent values, delinquent peer associations, and family influences. In combination, these design features provide a strong assessment of this issue. Our central hypothesis is that truancy is significantly associated with the onset of marijuana use, even after the impact of potential shared risk factors is controlled.

Theoretical framework for the relationship between truancy and the onset of marijuana use

There are good theoretical reasons to expect an association between truancy and the subsequent initiation of marijuana use. Indeed, the idea that school-related problems and substance use co-exist has been incorporated into many theories of adolescent development. One of the clearest statements of this expectation is found in theories that share a social control perspective. Adolescents who lack strong bonds to pro-social people and institutions are less constrained and more likely to engage in delinquency (Hirschi, 1969). Involvement is one of the four central elements of the bond, and disengagement from school, as represented by truancy, is a classic indication of low conventional involvement for adolescents. Because of this, truancy is likely to enhance directly the behavioral freedom that is associated with the onset of problem behaviors such as marijuana use.

This core assertion of control theory is also embedded in several current developmental theories of problem behavior (Catalano and Hawkins, 1996; Elliott et al., 1979; Thornberry, 1996; Thornberry and Krohn, 2005). These models stress the importance of school bonding as a critical component in the etiology of substance use. When students are poorly bonded to school, as is often the case with truants, they are more likely to become bonded to antisocial others, and it is the confluence of low conventional bonds coupled with bonding to delinquent peers that results in initiation and continued involvement in drug use and related problem behaviors. This observation has led to school intervention programs designed to increase success and bonding at school to reduce substance use (Abbott et al., 1998; Battistich et al., 1999; Catalano et al., 2004; Schaps and Solomon, 1990).

Osgood and colleagues (Osgood and Anderson, 2004; Osgood et al., 1996) and Stoolmiller (1994) focus on one of the possible mechanisms by which truancy might lead to marijuana use. They propose that unstructured, unsupervised time with peers creates a setting that is likely to propagate delinquency. The absence of adult authority figures limits the likelihood that adolescents will respond to social control pressures to behave in a pro-social manner, and exposure to delinquent peers in these types of settings may instigate delinquent behavior as well as make delinquent acts easier to carry out and more rewarding. Truancy, by its very nature, provides exactly this type of setting. When students are truant from school, they are much more likely to be unsupervised as well as unoccupied with pro-social activities.

All these models share a core expectation that truancy will lead to an increase in marijuana use, either directly by reducing a major source of social control over adolescents, indirectly by increasing the likelihood of deviant peer affiliations, or both. Also implicit in these theories is a dose-response model; as the frequency of truancy increases, the level of conventional involvement diminishes, opportunities for deviant peer interactions escalate, and problem behaviors like marijuana use should become more likely. All of this leads to our core hypothesis that truancy, especially chronic truancy, will be associated with the onset of marijuana use.

Potential confounding variables for the relationship between truancy and initiation of marijuana use

If there is an empirical association between truancy and marijuana use, it may of course be spurious. That is, the relationship between truancy and the onset of marijuana use may simply be a function of shared risk factors. For example, a student who is poorly bonded to family or who is failing academically will be more likely to both skip school and initiate use of drugs. To increase the likelihood that the truancy effect is potentially causal, we have identified four sets of possible confounding variables that may account for both truancy and initiation of marijuana use: school variables, general problem behavior variables, peer variables, and family variables.

First, although it is possible that truancy itself exerts an influence on marijuana use, it is also quite plausible that truancy is merely symptomatic of earlier and more general school failure and that it is really a lack of school commitment and success that leads to both truancy and marijuana use. Consistent with this, many studies (e.g., see Bryant et al., 2003; Bryant and Zimmerman, 2002; Krohn et al., 1997) have shown that both poor school commitment and poor academic performance are salient predictors of drug use.

Second, truancy may not cause the initiation of drug use, but rather students who have a propensity for delinquency may both skip school and use drugs (Jessor and Jessor, 1977). This general propensity for deviance may be captured by a young person's attitude toward delinquency and their prior involvement in other types of delinquency.

Third, other theories, including social learning theory (Bandura, 1977), primary socialization theory (Oetting and Donnermeyer, 1998), and peer cluster theory (Oetting and Beauvais, 1986, 1987), emphasize the role of peers and social learning. This orientation emphasizes the learning of behaviors and beliefs supportive of those behaviors, often in the peer context. Those with deviant peers are thus more likely to obtain social rewards for involvement in deviance, including both truancy and marijuana use. Under this framework, the relationship between truancy and initiation of marijuana use may also be spurious if associating with peers who hold delinquent values causes a youth to both skip school and use substances.

Fourth, a great deal of research has identified the importance of family on the pro-social development of youth in general (Bronfenbrenner, 1986; Repetti et al., 2002) and, in particular, with regard to substance use (Velleman et al., 2005). Specifically, poor or ineffective parenting, poor parental monitoring, and low attachment between parent and child have all been identified as risk factors for substance use among young people (National Institute on Drug Abuse, 1997), as well as more general forms of antisocial behavior that could include truancy (Loeber and Stouthamer-Loeber, 1986). In addition, low parental education and family poverty may also exert a significant influence on both truancy and the initiation of drug use (Brooks-Gunn et al., 1997). Thus, to the extent that these family variables increase an adolescent's involvement in both behaviors, then the relationship between truancy and drug use may be spurious.

To help ensure that the effect of truancy is not spurious, we adjusted for shared risk factors in each of these domains. Specifically, we assessed the effect of truancy on the initiation of marijuana use after adjusting for commitment to school, grade-point average, delinquent values, prior involvement in property and violent crimes, peer reactions to delinquency, parental monitoring, affective ties to child, positive parenting, parental education, and family poverty.

In summary, although there is both theoretical and empirical support for hypothesizing a legitimate relationship between truancy and the onset of marijuana use during adolescence, the available research supporting this is meager. By assessing the effect of truancy on the initiation of marijuana use using a longitudinal sample of youth and controlling for shared risk factors, we hope to contribute new knowledge about the effect of truancy on a particularly salient problem behavior among adolescents.

Method

Data

The data for this study are from the Rochester Youth Development Study (RYDS), a multigenerational panel study of child, adolescent, and young adult development. During the 1987-1988 school year, 1,000 students in seventh and eighth grade who were enrolled in the public school system in Rochester, New York, were selected. The primary purpose of the Rochester study was to examine the development of serious delinquency, violence, and drug use. As such, youth at high risk for engaging in these behaviors were oversampled. In this study, we restricted the sample only to students who provided data on at least two of the measurement occasions—this limits the sample size to 969. Sampling weights were used to obtain population estimates. In total, 68% of the sample was black, 17% was Hispanic, and 15% was white. Because of the oversampling, only 27% of the subjects were female.

During adolescence, the target students and their primary caregiver were interviewed separately, at 6-month intervals, from 1988 (average age = 14 years) to 1992 (average age = 18 years). Procedures to protect human subjects were approved by the University at Albany's Institutional Review Board and included written informed parental consent, student assent for those younger than age 18 years, and written informed consent thereafter. Students were typically interviewed in private rooms at school (unless they had dropped out or moved, in which case they were interviewed in alternative, but private, locations), and the primary caregivers

were typically interviewed at home. In the analyses presented here, we used all available data for each student through age 16.5 years. We limited the assessment of truancy on the initiation of marijuana use to this age to avoid assessing the relationship after many students had begun to drop out of school (i.e., when school attendance is no longer obligatory). Because we assessed the lagged effect of truancy on the initiation of marijuana use, the last year that students reported truancy in this study was age 16 years (which predicts initiation of marijuana use at age 16.5 years).

Measures

The dependent variable of interest—marijuana use—was measured at each wave of data collection. At the first wave, students were asked if they had ever tried marijuana and, if so, their age the first time. Students were also asked how many times in the previous 6 months they had used marijuana. At each of the subsequent waves, students reported the number of times they had used marijuana since their previous interview. Using these data, an age at first use was constructed for each student in the sample who initiated.

The primary independent variable of interest, truancy, was also assessed at each wave. Students reported the number of times since the previous interview (or during the last 6 months for the first interview) they had skipped school without an excuse. Because of the timing of the interviews, the period that elapsed between each interview varied across students. For example, one student's Wave 3 interview took place in March 1989 and Wave 4 interview took place in September 1989; another student's Wave 3 interview took place in June 1989 and Wave 4 interview took place in December 1989. Although 6 months elapsed between interviews for each student, the amount of time that they were in school (because of summer break) differed. Also, although every effort was made to interview students with a 6-month interval, longer or shorter periods elapsed between measurement occasions for some students in some waves. Therefore, we calculated the number of school days that elapsed between the two interview dates for each set of dates for each student. We then divided the number of times the students reported skipping school by their number of possible school days. To arrive at a number that approximated a percentage, we multiplied this number by 100 (i.e., [the number of times the student skipped school/the number of school days] × 100). This value is highly skewed; therefore, we imposed a natural log transformation.

To assess the unique effect of truancy, several control and potential confounding variables were assessed. First, dummy variables for both gender (coded as 1 for male, 0 for female) and race/ethnicity (comparing black and Hispanic students with white students) were included in all models. Two time-dependent potential school-related confounders were included. Commitment to school was a nine-item scale (e.g., student tries hard in school, student feels that getting good grades is important); reliability ranged from .75 to .85 across waves. Grade-point average was collected from official school records. Prior involvement in delinquency was measured at the first wave, indicating the frequency of involvement in 20 property and violent crimes. A natural log transformation was applied to account for the heavily skewed nature of this variable. Measures of delinquent values and the student's perception of peer reactions to their delinquency were included as time-dependent potential confounders. The scale for delinquent values included 10 items (e.g., how wrong is it to use drugs, commit crimes, etc.), and the scale for peer reactions to delinquency included 9 items (e.g., what would the student's friends say if he/she used drugs, committed crimes, etc.). Scale reliability for delinquent values ranged from .80 to .90 across waves; scale reliability for peer reactions to delinquency ranged from .80 to .88. Finally, five family-related potential confounding variables were included. All variables were reported by the primary caregiver. The number of years of education of the parent/caregiver and a dichotomous measure of whether the family ever reported living below the poverty level in Waves 1-4 were both included as time-independent covariates. Three other family-related confounders were measured as time-dependent covariates. Monitoring was composed of seven items indicating the extent to which the primary caregiver is aware of the student's whereabouts, friendships, and activities (scale reliability ranged from .68 to .83 across waves). Positive parenting was a five-item scale that measured the parent's rewarding of pro-social behavior of the child through praise, hugs, and the like (scale reliability ranged from .62 to .71 across waves). Affective ties to the child was an 11-item scale that assesses the extent to which the parent has a strong bond with the student (scale reliability ranged from .80 to .86 across waves). All potential confounders were coded such that a higher score represented at-risk status (i.e., low commitment to school, low grade-point average, high delinquent values, high prior involvement in crime, positive peer reactions to delinquency, low parent education, family poverty, low monitoring, low positive parenting, and low affective ties).

The aggregated correlation matrix for independent variables is presented in the Appendix. To obtain these, we estimated the correlation matrix at each wave. Then, we averaged each correlation across waves. We also present the standard deviation of the correlations across waves.

Analysis

To analyze the research question of interest—the effect of truancy on the initiation of marijuana use—we used a discrete-time proportional odds survival model (Allison, 1995; Singer and Willett, 2003). This type of model has several attributes that are well suited to testing the proposed

hypotheses. First, survival models consider the timing as well as the occurrence (or nonoccurrence) of the first use of marijuana. Second, discrete-time survival analysis models right-censored data and properly accounts for the fact that many students will not initiate use during the observation period. Third, this type of survival model allows for the inclusion of time-dependent covariates and time-by-independent-variable interactions. These interactions allow one to examine whether the effect of a certain covariate changes over time, for example, whether the effect of school commitment on the initiation of marijuana use changed as the students progressed further into adolescence. Finally, the model allows for a discrete specification of time. In our data, the initiation of marijuana use was measured at intervals along a time scale; therefore, we do not know the precise time when initiation occurred. Rather, we only know that it occurred within a certain 6-month interval.

Proportionality is an important assumption of survival analysis. Specifically, the effect of covariates are assumed to have a similar effect across all ages (e.g., the effect of truancy is the same at age 13 years as it is at age 16 years). This assumption may be tested by including a series of interactions between the time indicators and each covariate. In the analyses presented here, proportionality was assessed through three interactions for each variable that compared the effect of the covariate on initiation at age 13 and 14 years (i.e., age 13, 13.5, 14, and 14.5 years), at age 15 years (i.e., age 15 and 15.5 years), and at age 16 years (i.e., age 16 and 16.5 years). For example, the interaction between truancy and the age 15 indicator captures the average effect of truancy on the initiation of drug use within the subsequent 6 months during the year that the student turned 15 years old (i.e., age 14.5 truancy on age 15 marijuana use initiation and age 15 truancy on age 15.5 marijuana use initiation). Ages 13 and 14 years were combined because of the sparseness of data at age 13 years owing to the age at entry into the study (the average age was 14 years at Wave 1). The deviance statistics for the fixed and free models were compared (the difference between the two deviance statistics is chi-square distributed with degrees of freedom equal to the difference in the number of parameters). We examined the proportionality assumption of truancy and all other covariates. The only variable that violated the proportionality assumption was truancy, indicating that the effect of truancy changed over time. The interaction of truancy and age was retained in all subsequent analyses; that is, the effect of truancy was allowed to be different at age 13/14 years, age 15 years, and age 16 years.

Although retention in the study was and remains high (at the end of the adolescent phase of data collection, which represents the data presented in this article, 881 of the original 1,000 students remained in the study), there were some missing data. To appropriately handle missing data, we employed multiple imputation. The imputation was carried out using SAS, Version 9.12 (SAS Institute, Inc., Cary, NC). In total, 10 imputed datasets were created. All analyses were performed on each of the imputed datasets, and the parameter estimates were then combined using the procedures outlined by Rubin (1987).

Results

We began by investigating the relationship between truancy and marijuana use from a descriptive standpoint, assessing the onset ordering of both behaviors. Cross-tabulations revealed that, overwhelmingly, truancy preceded marijuana use. Six percent of the students started skipping school and using marijuana during the same 6-month period, 20% percent of students did not skip school or try marijuana through age 16 years, 68% of students started skipping school before starting to use marijuana (or never initiated marijuana use), and only 6% of students reported trying marijuana before ever skipping school (or never started skipping school).

Next, we assessed the primary process of interest—the onset of marijuana use during adolescence. We first fitted an unconditional survival model—that is, a survival model that included only one time indicator for each age. Figure 1 presents the survival probabilities obtained from this model. Survival probabilities cumulated the risk of initiation at each age to assess the probability that a randomly selected adolescent would survive (i.e., not initiate use of marijuana) through period *j*. The figure demonstrates that as the students grew older, the survival probability declined (i.e., more and more students initiated marijuana use). The probability of not initiating marijuana use through age 16.5 years was .71. In total, 282 of the 969 students considered in this study had tried marijuana by age 16.5 years. According to the 1992 wave of the Monitoring the Future Study (which is the final year of the adolescent portion of the current study), the lifetime use rate for marijuana use was 21.4% among 10th-grade students (10th-grade students are on average 16.5 years old) (Johnston et al., 2006). The lifetime use rate reported here is higher; this is likely the result of the urban population and the oversampling of high-risk students for this study.

After specifying an unconditional discrete-time survival model, we extended the model by including the control variables (gender and race/ethnicity), the primary covariate of interest (truancy), and all potential confounders (commitment to school, grade-point average, delinquent values, peer reactions to delinquency, prior involvement in delinquency, parent education, family poverty, parental monitoring, affective ties to child, and positive parenting). Truancy and all of the time-dependent potential confounders were included as lagged time-dependent covariates to obtain the correct temporal ordering for our hypothesis. Because the lagged assessment of truancy and the potential confounders are considered as predictors of the onset of marijuana use, students

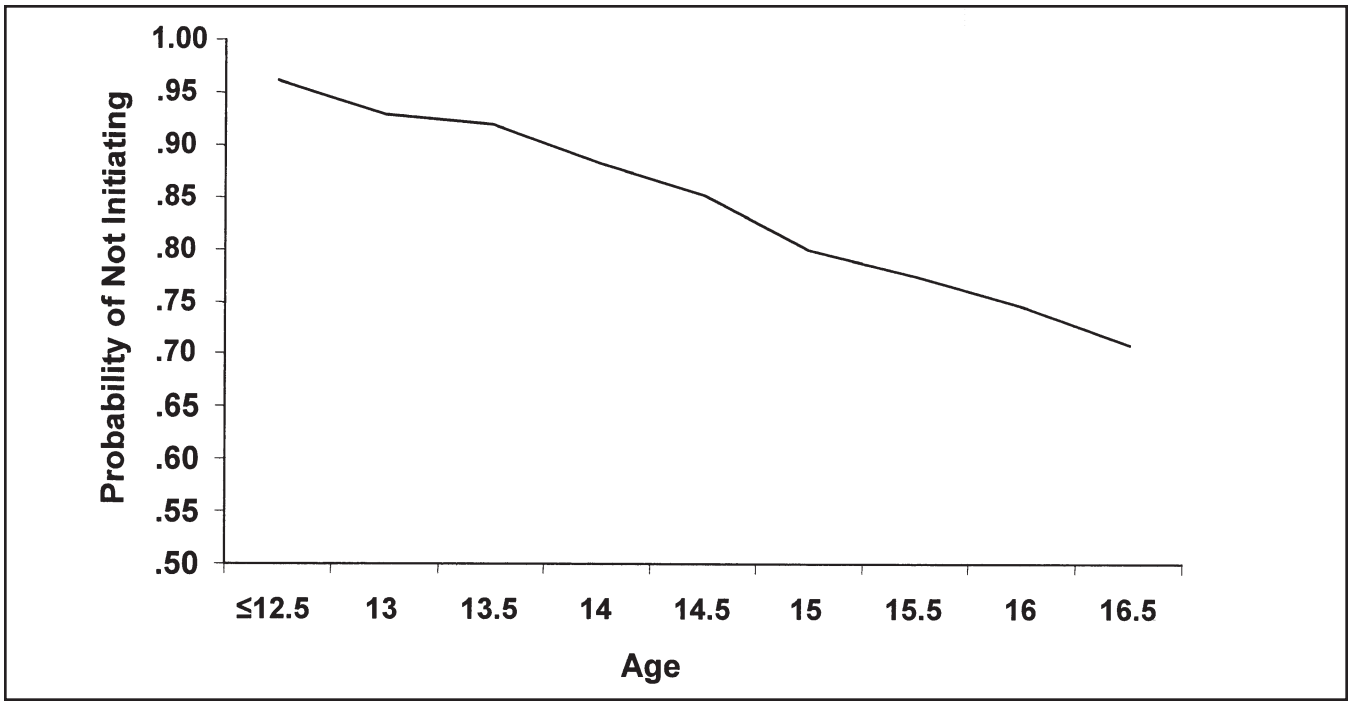

FIGURE 1. Fitted survival probabilities for onset of marijuana use

who had initiated use before the beginning of the study had to be excluded from the conditional models. Given that the study started in mid-adolescence (i.e., the average age at the beginning of the study was 14 years), the number of left-censored cases is fairly large. In total, 103 of the students initiated drug use before the beginning of the study and were therefore excluded from further analyses (see the Limitations section for a discussion of this).

The results of these initial models are presented in Table 1 in the unadjusted effects column. The odds ratios indicate the effect of truancy and each potential confounder on initiation after adjusting only for the time indicators, gender, and race/ethnicity. The results indicate that truancy significantly elevated the odds of initiation of marijuana use during the following 6-month period; that is, the higher the truancy, the higher the odds of starting to use marijuana. In addition, when assessed independently, all time-dependent potential confounders and prior involvement in delinquency significantly predicted the odds of initiation during the following 6 months; however, the two time-independent potential confounders (parent education and family poverty) did not have a significant effect on initiation after controlling for gender and race/ethnicity.

Finally, we include all variables in a single model. The results are presented in Table 1 in the adjusted effects columns. The values associated with the time indicators in this model (e.g., age 13, age 13.5, etc.) represent the odds of initiation of drug use at each particular age for an individual with an average score on all covariates (i.e., all covariates were grand mean centered). The values associated with all other covariates represent the odds ratio for a one-unit increase in the covariate score. After adjusting for all potential confounders, truancy is significantly associated with increased odds of initiation of marijuana use during the subsequent 6 months. This effect is demonstrated at all three ages: 13/14 years, 15 years, and 16 years. Other significant predictors in the full model include gender (after adjusting for all other variables, females had a higher odds of initiation), grade-point average (lower performance was associated with higher odds of initiation), peer reactions to delinquency (positive peer reactions to the student's delinquency were associated with higher odds of initiation), delinquent values (higher delinquent values were associated with higher odds of initiation), and prior involvement in delinquency (more involvement was associated with higher odds of initiation).

To present these findings in a more intuitive way, we calculated the predicted probability of the initiation of marijuana use at age 14.5 years (i.e., during the 6-month period that elapsed between the age 14 interview and the age 14.5 interview) as a function of truancy at age 14 years. This allows us to assess the odds of initiation at age 14.5 years among students who had not yet begun using marijuana at age 14 years. Using the average levels for gender and race/ethnicity and all potential confounders, we estimated the probability of initiation for a nontruant, a truant who skipped 5 times out of 100 days, and a truant who skipped 10 times out of 100 days. The predicted probability of initiation for these three types of students is reported in Figure 2.

The results show a clear dose-response effect; as the level of truancy increases, so too does the probability of

TABLE 1. The effect of truancy on the initiation of marijuana use

Variable	Unadjusted effects OR (95% CI)	Adjusted effects OR (95% CI)
Age 13[a]		0.01 (0.00-0.21)
Age 13.5[a]		0.02 (0.01-0.07)
Age 14[a]		0.04 (0.02-0.07)
Age 14.5[a]		0.03 (0.02-0.05)
Age 15[a]		0.06 (0.04-0.09)
Age 15.5[a]		0.02 (0.01-0.03)
Age 16[a]		0.02 (0.01-0.03)
Age 16.5[a]		0.02 (0.01-0.04)
Gender, male compared with female		0.57 (0.38-0.84)
Black, compared with white		0.94 (0.54-1.63)
Hispanic, compared with white		0.49 (0.24-1.03)
Low parent education	1.05 (0.97-1.13)	1.02 (0.93-1.12)
Family lives in poverty	1.27 (0.93-1.74)	1.08 (0.73-1.60)
Truancy at ages 13/14 years	3.96 (2.78-5.65)	3.07 (2.09-4.50)
Truancy at age 15 years	2.22 (1.80-2.75)	1.64 (1.29-2.09)
Truancy at age 16 years	1.79 (1.45-2.20)	1.38 (1.10-1.73)
Low school commitment	4.77 (2.99-7.61)	1.16 (0.67-2.00)
Low grade-point average	2.17 (1.75-2.70)	1.72 (1.31-2.26)
Peer positive reactions to delinquency	5.10 (3.20-8.11)	2.39 (1.32-4.35)
Student's delinquent values	4.95 (3.22-7.59)	2.36 (1.37-4.09)
Student's involvement in delinquency at baseline	1.61 (1.39-1.86)	1.38 (1.14-1.68)
Poor parental monitoring	2.29 (1.22-4.28)	1.04 (0.47-2.31)
Low affective ties to child	2.25 (1.62-3.13)	0.99 (0.57-1.73)
Low positive parenting	1.51 (1.11-2.05)	1.21 (0.84-1.73)

Notes: Unadjusted effects assess truancy's and each potential confounder's effect adjusting only for age, gender, and race/ethnicity. Adjusted effects assess truancy's and each potential confounder's effect adjusting for all other variables. [a]The coefficients for the age variables are multiple intercepts and represent odds not odds ratios.

the initiation of marijuana use. Comparing the extreme categories in Figure 2 provides a sense of the magnitude of this effect. Given two students who demonstrated the same score for all potential confounders but differed on their level of truancy at age 14 years (one was a nontruant and one skipped about 10 times per 100 days of school), we would have expected that the student who demonstrated no truancy would have a .01 probability of initiating marijuana use during the following 6 months, whereas the high-level truant would have a .17 probability of initiating use during

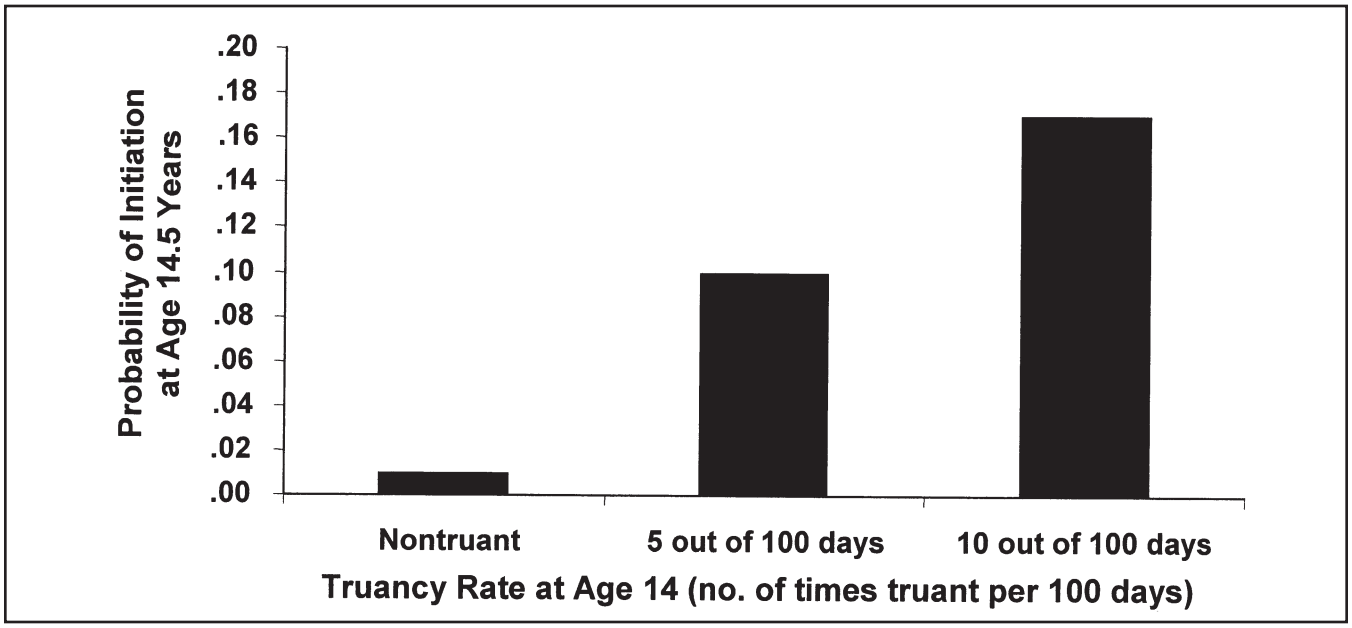

FIGURE 2. Predicted probability of initiation of marijuana use at age 14.5 years as a function of truancy at age 14 years

the following 6 months. In sum, truancy is an important predictor of the initiation of marijuana use.

Discussion

The results of this study provide evidence for a robust effect of truancy on the initiation of marijuana use. Consistent with our hypothesis, truancy is significantly associated with an increased odds of initiation of marijuana use during the following 6-month period, even after adjusting for gender, race/ethnicity, and key potential confounding variables. By carefully selecting potential confounders in multiple domains (i.e., school, behavior and values, peer, and family), we have decreased the likelihood that the relationship between truancy and the initiation of marijuana use is spurious. Put differently, we have increased the likelihood that the effect of truancy on the initiation of marijuana use is, at least in part, causal.

The results reported here are also quite consistent with our theoretical expectations derived from control theory. As adolescents become disengaged from the conventional venue of the school, one would expect that involvement in a variety of problem behaviors, such as marijuana use, would increase. This may be the result of the direct effect of reduced social control in pro-social settings or to that combined with increased exposure to deviant influences. By its very nature, truancy is likely to provide a context for initiation because of the unstructured and unsupervised time that it provides (Osgood and Anderson, 2004; Osgood et al., 1996; Stoolmiller, 1994). Data from the Rochester sample indicate that truant youth tend to skip school in pairs or groups (across waves, 62%-70% of truants said that they skipped school with other students).

Although truancy is a significant predictor of initiation throughout the observation period, it is particularly robust in earlier adolescence, at ages 13 and 14 years. Indeed, its impact at early ages is approximately twice as large as its impact at later ages. This finding may exist because truancy is less normative—and, therefore, more precocious—in earlier adolescence. A general premise of life-course theory (Elder, 1998) and life-course theories of delinquency (Thornberry, 2005) is that early transitions are more disruptive to subsequent development and have more serious negative consequences than age-normative transitions. This pattern has been observed in a number of developmental domains (Krohn et al., 1997; Newcomb and Bentler, 1988) and appears to extend also to school disengagement as reflected by truancy. One mechanism for this effect may be via the changing role of parental supervision. Developmental theories (Thornberry, 1987) expect and empirical studies (Jang and Krohn, 1995; Jang and Smith, 1997; LaGrange and White, 1985) have shown that parental monitoring declines with age. As a result, younger adolescents have fewer opportunities for unmonitored, unstructured time with peers because parental monitoring tends to be higher in earlier adolescence. Therefore, the larger effect of truancy in early adolescence may be observed because it offers an opportunity for unsupervised, unstructured time with peers. We find some preliminary evidence of this in the Rochester data; the correlation between a scale that measures unsupervised time with friends and involvement in truancy ranges between .12 and .20 across time. We are currently conducting a follow-up study to better understand the relationships among truancy, unsupervised time with friends, and drug use. Regardless of the reason for the larger effect in earlier adolescence, these results suggest that truancy prevention initiatives should begin early (i.e., in elementary and middle school) and continue into high school.

As demonstrated by the parameter estimates and the predicted probabilities presented in Table 1 and Figure 2, truancy is indeed a robust predictor of initiation. However, not nearly enough work has been done to prevent truancy. Given the results presented in this article along with previous studies that have demonstrated the harmful consequences of truancy, more research into the etiology of truancy and the prevention of truancy is necessary.

These findings offer important suggestions for prevention. Programs aimed at reducing truancy may have ripple effects—deterring drug use, delinquency, and other problem behaviors. In one study, Garry (1996) reported that shoplifting arrests declined by 60% and purse snatching dropped by nearly 50% when intensive truancy sweeps were conducted by the police. Several other recent studies have reported on the effectiveness of school- and community-based truancy prevention programs (Fantuzzo et al., 2005; McCluskey et al., 2004), demonstrating encouraging results.

Focusing on truancy prevention as a way to reduce the onset of drug use and other problem behaviors has several appealing features. First, as shown here, truancy—especially early truancy—has a sizeable effect on the initiation of marijuana use, and truancy prevention may therefore have substantial deterrent payoffs. Second, truancy is one of the more public risk factors for subsequent problem behaviors. Unlike many risk factors, for example, child maltreatment or delinquent values, truancy is virtually impossible to hide. It can be easily and economically monitored by school officials to target services at the appropriate students and their families. Third, it may be a particularly appealing prevention strategy to implement within the school setting. Truancy prevention has direct benefits to both educators (because truant students are not learning when they are not in school) and drug preventionists (because truant students are more likely to become involved with drugs). This is a salient issue given the school's primary mission to educate (and increasingly to demonstrate educational success) and the limited amount of time that schools have to dedicate to prevention initiatives. School-based prevention initiatives may be better received if school personnel perceive that the outcomes may have academic benefits as well.

Several promising strategies for reducing truancy have been proposed. In 1998, the Office of Juvenile Justice and Delinquency Prevention and the Department of Education started the Truancy Reduction Demonstration Program. This initiative helps identify critical components that are predictive of positive outcomes for children and families, including collaboration among key agencies, creation of a context of support, family involvement, comprehensive approaches, and the use of incentives and sanctions (National Center for School Engagement, 2005).

Another promising avenue focuses on targeting the school environment. Several studies have demonstrated that many aspects of the school environment play important roles in determining the likelihood that an adolescent will follow a pro-social path through adolescence as opposed to becoming involved in delinquent behavior. In a review of the literature, Gottfredson (2001) concluded that school context variables exert a moderate effect on several negative outcomes and that improvement of the school context (i.e., initiatives aimed at improving school-level factors and policies) may have important and beneficial outcomes on student behavior. Although a great deal of work needs to be done to determine the efficacy of these programs, they should be explored as effective means for reducing truancy and subsequent problem behaviors.

Limitations

The average age of the students at the beginning of the study was 14 years. This represents a relatively late period of adolescence to assess the onset of marijuana use, and as reported in the results section, 103 of the students in the sample had tried marijuana before the study began. This left censoring (i.e., initiation before the study began) for the most part was random because it was the result of the wide but relatively late age at entry for many students (i.e., students ranged from 11.5 to 15.5 years old at the first interview—they were in seventh or eighth grade) and, therefore, was unlikely to bias the results presented here. Eighty of the 103 students who had already begun using marijuana at the beginning of the study were 14 years old or older (i.e., at or above the mean age at the first interview). Moreover, most of these 103 students did not initiate marijuana use before age 13 years (as depicted in Figure 1, less than 4% of the total sample initiated use before age 13 years). Fortunately, the loss of these students did not adversely affect the power to detect significant effects of truancy in this study (as demonstrated in Table 1). However, given that we could not model the initiation process before age 13 years, these results should not be generalized to children less than 13 years of age. In sum, although a younger sample would have been preferable (and this is indeed important future work), there is so little prior work on this topic that these results make a significant and important contribution to the current literature.

Future directions

This study provides important information about the effect of truancy on the initiation of marijuana use, demonstrating that students who are truant are more likely to initiate the use of marijuana. However, the study also indicates the need for further investigation of this topic. First, there is the need for a better understanding of the personal and environmental factors that lead to school truancy and better evaluations of programs designed to minimize these factors.

Additional research is also needed to understand the context of a truant day; that is, what kinds of activities take place while adolescents are truant from school? This research will help us to understand more clearly the role that truancy plays in providing an environment where drug use and related behaviors can propagate.

This study considers the effect of truancy on the initiation of marijuana use, but further research is needed to understand the effect of truancy on escalation of the use of marijuana and other drugs. In addition, reciprocal effects should be evaluated to determine if escalation of marijuana use has, in turn, a deleterious effect on school attendance (Krohn et al., 1996).

Finally, it is interesting to note that commitment to school and family factors are not significant predictors of the initiation of marijuana use after adjusting for truancy, school performance, peer reactions to delinquency, and delinquent values. Future research should assess the extent to which truancy may mediate the effect of other school- and family-related risk factors on the initiation of marijuana use; that is, perhaps the effect of these variables on initiation (as demonstrated in the univariate models) is partly explained by truancy.

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APPENDIX. Correlation matrix for truancy and all potential shared risk factors (i.e., confounders)

	1	2	3	4	5	6	7	8	9	10	11
1. Low parent education	**1.00**	*.00*	*.03*	*.04*	*.03*	*.02*	*.00*	*.02*	*.05*	*.02*	*.03*
2. Family lives in poverty	.31	**1.00**	*.04*	*.04*	*.02*	*.02*	*.00*	*.03*	*.03*	*.01*	*.03*
3. Truancy	.04	-.02	**1.00**	*.04*	*.01*	*.03*	*.06*	*.03*	*.07*	*.03*	*.05*
4. Low school commitment	-.02	-.03	.34	**1.00**	*.08*	*.04*	*.06*	*.05*	*.03*	*.03*	*.04*
5. Low grade-point average	.14	.15	.32	.34	**1.00**	*.05*	*.03*	*.05*	*.05*	*.03*	*.03*
6. Peer positive reactions to delinquency	-.02	-.02	.29	.27	.13	**1.00**	*.04*	*.04*	*.04*	*.05*	*.04*
7. Student's involvement in delinquency	.04	.00	.25	.17	.21	.28	**1.00**	*.06*	*.03*	*.01*	*.03*
8. Student's delinquent values	-.02	-.01	.29	.34	.14	.47	.28	**1.00**	*.05*	*.06*	*.04*
9. Poor parental monitoring	.08	.07	.11	.11	.18	.10	.09	.10	**1.00**	*.03*	*.05*
10. Low affective ties to child	.07	.06	.18	.19	.23	.15	.19	.14	.33	**1.00**	*.03*
11. Low positive parenting	.05	.03	.06	.12	.06	.08	.05	.08	.25	.26	**1.00**

Note: Correlations are on the bottom diagonal and standard deviations (of correlations across waves) are on the top (*italic*) diagonal.