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College Degree Attainment by Age of First Marijuana Use and Parental Education

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Abstract

Background: Age of first marijuana use is a key predictor of later educational outcomes, but limited work has identified demographic factors that impact this association across continuous ages of first use. The purpose of this study was threefold: 1) to identify the age-varying prevalence of later college degree attainment as a function of age of first marijuana use; 2) to examine the age-varying association of gender and college degree attainment as a function of age of first use; and 3) to examine the age-varying association of parent education and college degree attainment as a function of age of first use.

Methods: Data were from the panel portion of the Monitoring the Future (MTF) study, an ongoing longitudinal study of adolescents and young adults. Those who used marijuana by age 22 were included in analyses. Among these participants (N=2,134), 47.0% were male, 67.5% were White, 53.2% reported having at least one parent with a bachelor's degree or higher, and 44.1% attained a bachelor's degree or higher by age 25/26.

Results: Intercept-only and logistic time-varying effect models (TVEMs) modeled prevalences and associations as functions of age of first marijuana use. Prevalence of college degree completion was relatively linear across age of first use, such college degree attainment increased as age of first use increased. Results indicated that college degree attainment varied across age of first use similarly for men and women. Degree attainment differences existed based on parent education. Parental education and degree attainment were most strongly linked at an age of first use between 16–19 years.

Conclusions: Findings suggest that age of first marijuana use has an association with academic achievement such that earlier ages of first use are associated with lower academic achievement

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later in adulthood. Parental education serves as a protective factor against college degree attainment in late adolescence.

Keywords

marijuana use; longitudinal; age of first use; college education; parental education

Marijuana use is increasing in the U.S.¹ and perceptions of risk associated with using marijuana have declined.² Frequent marijuana use is linked with a number of maladaptive health and behavioral outcomes, such as mental health problems, motor vehicle crashes, cognitive impairment, and lower postsecondary degree attainment.^{3,4} Among adolescents who used marijuana before age 21, the average age of first use was 16.2 years.⁵ Importantly, an early age of initiating substance use is widely supported as a risk factor for subsequent negative outcomes.^{6–8} In particular, early marijuana use poses risks for a variety of subsequent cognitive deficits.^{9–11} Relatedly, marijuana use is linked with poor academic outcomes.¹² The age at which an individual first uses marijuana appears to play a critical role in educational attainment outcomes, such that earlier marijuana use was prospectively associated with lower college enrollment, poor school performance, and early school leaving.^{13–15}

There are several key gaps in our knowledge about the effects of age of first marijuana use on educational outcomes. First, most prior work has examined age as a categorical variable (e.g., <15 years, 15–17 years, never before age 18¹⁴). Age measured continuously would provide a more refined view of specific ages at which age of first use is most strongly tied to education outcomes later in life. Second, there is limited knowledge of demographic factors that impact this association across age. Research on marijuana use and college educational outcomes by gender, for example, is mixed.^{14,16} Parent education is a strong predictor of college degree attainment¹⁷ and substance use.¹⁸ The association between age of first marijuana use and later college degree completion may be attenuated for those whose parents attained higher education degrees. Use of nuanced analytic techniques, such as time-varying effect modeling (TVEM), can flexibly capture the age-varying association between age of first marijuana use and college degree attainment by the mid-20s and the factors that impact this association.¹⁹ Such an analysis would highlight ages at which and for whom prevention efforts are most needed.

Current Study

The purpose of our study was to better understand the association between age of first marijuana use and college degree attainment by addressing the following research questions:

- 1) How does the prevalence of college degree attainment vary across age of first marijuana use?
- 2) How does the association between gender and college degree attainment vary across age of first marijuana use?
- 3) How does the association between parent education and college degree attainment vary across age of first marijuana use?

Methods

Participants and Procedure

This study used data from the panel portion of the Monitoring the Future (MTF), an ongoing study of adolescents and young adults.²⁰ Each year since 1976, a nationally representative sample of about 15,000 high school seniors has been surveyed in their classrooms (modal age 18). Approximately 2,400 respondents of each senior class are selected for biennial follow-up via mailed surveys, with a random half of the sample first surveyed one year after high school (modal age 19) and the other half surveyed two years after high school (modal age 20).²¹ Students were randomly assigned to one of six survey forms. Age of first marijuana use was included on two of six forms; a random one-third of the sample was included in this study.

Those who completed the age 25/26 survey from 2005 to 2015, had tried marijuana by age 22, and had valid data on their age of first marijuana use were included in the main study analyses ($n = 2,134$). The analytic sample excluded 514 who did not respond to the age of first use question and 177 who had not used marijuana by age 22. Age of first use was truncated at age 22 given that many individuals had completed their bachelor's degree by this age. The analytic sample was 47.0% ($n = 875$) male, 53.2% ($n = 1,158$) reported having at least one parent with a bachelor's degree or higher, and 44.1% ($n = 1,003$) indicated having attained a bachelor's degree or higher by age 25/26. For race/ethnicity, 67.5% ($n = 1,682$) identified as White, 11.6% ($n = 118$) as Black, 10.7% ($n = 154$) as Hispanic, 3.1% ($n = 57$) as Asian, and 7.0% ($n = 123$) as other race/ethnicity.

Measures

Gender and race/ethnicity were measured by self-report at age 18. Parental education was reported by the respondent at age 18, based on responses to the highest level of schooling completed by the participant's mother and father (1 = at least one parent attained a bachelor's degree or higher; 0 = neither parent attained a bachelor's degree). College degree attainment was assessed by self-report at modal age 25/26 (1 = attained a bachelor's degree or higher by age 25/26; 0 = did not attain a bachelor's degree by age 25/26). Age of first marijuana use was assessed at age 18 by asking participants, "When (if ever) did you FIRST try marijuana or hashish?" Response options included *Never*, *Grade 6 or earlier*, and *Grade 7, 8, 9, 10, 11 or 12*. Modal age was coded for each grade: 12, 13, 14, 15, 16, 17 and 18, respectively. Those who reported *Never* at age 18 were included if they reported lifetime marijuana use at either of their first two follow-up surveys; in this case, age of first use was then coded based on the modal age of the survey at which they first reported lifetime use (modal ages 19, 20, 21, or 22).

Analytic Plan

Time-varying effect modeling (TVEM) is an analytic technique for estimating associations as flexible, non-parametric functions of continuous time. Intercept-only TVEMs estimated the prevalence of degree attainment at age 25/26 as a flexible function of age of first marijuana use (from ages 12 to 22). Logistic TVEM was used to model the association between gender and college degree attainment at age 25/26 as well as parental education and

degree attainment, by age of first marijuana use. When results indicated significant associations at any age of first use, an intercept-only TVEM was used to examine the prevalence of degree attainment at age 25/26 separately by the subgroups (i.e., males vs. females; parent with degree vs. parent without a degree). All TVEM models were conducted in SAS 9.4 using the %WeightedTVEM macro.²² Weights calculated to account for sampling and attrition through age 25/26 were incorporated in all analyses.

Results

The estimated prevalence of college degree attainment by age 25/26 by age of first marijuana use is presented in Figure 1 ($n = 2,125$; 9 individuals were missing on their educational outcomes). Prevalence of college degree completion was relatively linear across age of first marijuana use, such that prevalence of individuals with a college degree increased as age of first marijuana use increased. Among those who first used at age 22, 68.2% of individuals attained a college degree by age 25/26. Rates were lowest at earlier ages of first use, with college degree attainment by 16.4% of those who used marijuana for the first time at age 12 or earlier.

Logistic TVEM was used to estimate the odds of college degree attainment by gender ($n = 2,125$) and parent education ($n = 2,079$; 55 individuals were missing on parent education and/or college degree attainment) as flexible functions of age of first marijuana use. For gender (not shown), confidence intervals for the odds ratio included 1.0 at all ages of onset, indicating men and women were at equal odds of completing college across all ages of first marijuana use.

Figure 2 depicts the odds ratio for the association between parent education and college degree attainment as a flexible function of age of first marijuana use. At all ages of first marijuana use, individuals were significantly more likely to attain a college degree if at least one parent had completed college. The degree to which the odds ratio varies across age of first marijuana use indicates a (possibly nonlinear) moderation effect of age of first use on the association between parent education and odds of degree attainment. While the effect was mostly age-invariant across age of first use, slight fluctuations in the curve indicated that the effect of parent education was strongest for those who first tried marijuana in late adolescence (approximately from ages 16 to 19). Those who first used marijuana at these ages and who had at least one parent with a bachelor's degree or higher had more than 5 times greater odds of attaining a college degree by age 25/26 than adolescents who first used marijuana between ages 16 and 19 and whose parents did not earn a college degree. In comparison, there were no significant differences in college degree attainment among those whose parents did and did not graduate from college among those who first used marijuana at age 22.

Figure 3 shows the estimated prevalence of college degree attainment by age of first use for those whose parent(s) attained a bachelor's degree (gray line) and those whose parents did not (black line). Points at which the confidence intervals do not overlap indicate significant differences between groups. Prevalence of college degree attainment across nearly all ages of first use were higher for those whose parents attained a degree than for those whose

parents did not, with the exception of age 22 (where the confidence intervals overlap). Larger differences existed from ages 16 to 19 in comparison to other ages; for example, among those who first used marijuana at age 17 and whose parent(s) attained a bachelor's degree, approximately 60% attained a college degree; approximately 25% of those who first used marijuana at age 17 and whose parent(s) did not attain a degree earned a college degree by age 25/26. That is, among those who first used marijuana at age 17, the prevalence of college degree attainment was about 35% higher for those whose parents had a college degree (compared to those whose parents did not have a college degree). This difference in college degree attainment by parental education was approximately 20% or less at ages of first use up to age 15 and after age 20.

Discussion

The current study estimated the prevalence of college degree attainment based on age of first marijuana use, and examined how this link varied by gender and parent education. Findings revealed that earlier ages of first use corresponded with lower prevalence of degree completion by age 25/26. While our findings are consistent with prior research on this topic,^{14,16} our study contributes to the literature in several important ways. Previous research has predominately examined age of first use as a categorical variable (e.g., prior to age 15 vs. after age 15). Prior work has examined educational outcomes by age of first marijuana use by comparing 3 categories of first marijuana use at <15 years, 15–17 years, or never before age 18 (Horwood et al., 2010). Using TVEM, we found there are large differences in the prevalence of later college degree attainment between age of first marijuana use at various ages. Such heterogeneity could not have been identified using coarse age categories. We also documented that degree attainment based on age of first marijuana use was similar for men and women, but that slight variations existed based on parent education indicating a protective effect in late adolescence. For example, for those whose age of first use was in late adolescence, there was an approximately 35% difference in the prevalence of attaining a degree between adolescents whose parent(s) did and did not earn a degree. However, for those whose age of first use was before age 15 or after age 20, there was a smaller (approximately 20%) difference. Overall, our findings are consistent with prior work on this topic that earlier ages of first use are critical risk factors for later educational outcomes^{13–15} but add that this association may be somewhat buffered by familial background in late adolescence.

Findings concerning early marijuana use, parent education, and later college degree attainment are interesting in light of research supporting that young adults from affluent families are more likely to engage in later problematic substance use and to use marijuana during young adulthood.¹⁸ While findings from prior studies have found that affluent youth, including youth with at least one parent who attained a college degree, are at greater risk for later substance use, our findings suggest that coming from a family where at least one parent has a bachelor's degree can protect youth from other consequences associated with marijuana use, including lower academic achievement. Although prevention efforts are needed for all youth to delay or prevent first marijuana use, there are important consequences of adolescent marijuana use for those in families in which neither parent attained a college degree.

Limitations include retrospective, self-report accounts of grade of first marijuana use and respondents' report of parent education. Participant responses may be impacted by recall biases for age of first marijuana use. For the parent education measure, due to the wording in the survey, it is not possible to determine whether the respondent lived with the parent(s) with the highest degree throughout their childhood, thus the effects presented may be underestimated.

Despite these limitations, our research highlights that earlier ages of first use have a long-term impact on educational attainment by age 25/26, but that familial factors such as parent education may serve as a buffer against some outcomes associated with using marijuana in late adolescence. Adolescent and young adult marijuana use is a rapidly changing landscape given changes in legislation for medical and recreational use of marijuana. These data are the most contemporary available from MTF, but it will be important to continue to examine the links between early marijuana use and young adult outcomes.

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Figure 1.

Intercept-only weighted time-varying effect model (TVEM) demonstrating the prevalence of college degree completion at age 25/26 by age of first marijuana use. Dashed lines represent 95% confidence intervals.

Figure 2. Logistic weighted TVEM of the association between parent education and college degree completion estimated as a nonparametric function of age of first marijuana use. Dashed lines represent 95% confidence intervals.

Figure 3. Intercept-only weighted TVEM demonstrating the prevalence of college degree completion by age of first marijuana use for individuals whose parents did not attain a bachelor's degree (black line) and those with at least one parent who earned a bachelor's degree or higher (gray line). Dashed lines represent 95% confidence intervals.