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Educational Paths and Substance Use from Adolescence into Early Adulthood

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Abstract

This study examined how substance use trajectories from ages 15 to 23 in a community sample (N=921) were related to educational pathways. Rates of heavy drinking converged across different paths, but starting college at a 2-year college before transferring to a 4-year college was related to later increase in drinking after high school. Higher future educational attainment was negatively associated with high school marijuana use, but marijuana use increased after high school for individuals who went to 4-year colleges compared to those who did not. Noncollege youth had the highest rates of daily cigarette smoking throughout adolescence and early adulthood, while college dropouts had higher rates of smoking than college students who did not drop out. The findings support the need for universal prevention for early adult heavy drinking, addressing increases in drinking and marijuana use in 4-year colleges, and targeting marijuana use and cigarette smoking interventions at noncollege youth and college dropouts.

A wealth of research has related higher education to substance use, comparing college students to their noncollege peers. However, simple college versus noncollege comparisons may obscure differences in the educational pathways. Despite the fact that close to a third of college students in the United States (U.S.) are enrolled in 2-year colleges (Fry 2009; Knapp et al., 2009), most studies of college versus noncollege differences in substance use have failed to make a distinction between 2- and 4-year college environments (Carter et al., 2010). Also, many individuals fail to complete postsecondary programs in which they enroll (Adelman 2006; Fry 2009). Research that measures educational status at a particular time may miss potential differences between future dropouts and those who stay in school. With a focus on 2-year versus 4-year college attendance and whether individuals drop out of college, the present study describes heterogeneity in educational pathways in a community sample and investigates how this heterogeneity is related to trajectories of heavy drinking, marijuana use, and cigarette smoking from adolescence into early adulthood.

Prior research with nationally representative samples (Bachman et al., 2008; O'Malley and Johnston 2002; Timberlake et al., 2007) has produced some consistent findings on the relationship between education and substance use trajectories in the U.S. During adolescence, individuals who fail to complete high school have higher rates of alcohol use, illicit drug use, and cigarette smoking compared to high school graduates, and rates of illicit substance use and cigarette smoking among the former group remain elevated relative to

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their peers into adulthood (Bachman, et al. 2008; Gfroerer et al., 1997). With respect to alcohol use, college-bound high school students report relatively low rates of use in adolescence but those who leave home to go to college catch up or surpass their noncollege peers in the period after high school (Bachman, et al. 2008; Bachman et al., 1997; Dawson et al., 2004; White et al., 2005; White et al., 2006). College students also have relatively low rates of marijuana use during adolescence, but as a group increase their use during college (Bachman, et al. 2008; Bachman, et al. 1997; Gfroerer, et al. 1997). Some research suggests the "catch-up" for marijuana use may not be as immediate as with alcohol use (White, et al. 2006). However, the difference in the prevalence or frequency of marijuana use lessens and, in some samples, disappears in the few years following high school for college students versus their noncollege peers (O'Malley and Johnston 2002; White, et al. 2006). In contrast to alcohol and marijuana use, cigarette smoking remains lower after high school among college students compared to their noncollege peers (Bachman, et al. 2008; Bachman, et al. 1997; Gfroerer, et al. 1997; O'Malley and Johnston 2002).

Categorizing individuals by whether they attend college at a given time point or by their educational attainment fails to capture the varied educational pathways that youth experience in the U.S. (Adelman 2006; Provasnik and Planty 2008). Of those individuals who do not go on to college, many go to vocational or trade schools. Also, many of those who go to college begin in 2-year (or shorter) programs at community colleges (which we refer to here as "2-year" colleges). In 2008, 30% of U.S. college students between the ages of 18 and 24 were enrolled in 2-year colleges (Fry 2009). Some of those who attend 2-year colleges stop after receiving an associate's degree or vocational certificate, while many transfer to 4-year institutions with the goal of attaining a bachelor's degree (Provasnik and Planty 2008). Additionally, the noncompletion rate for college students in the U.S. is high, particularly for those who start at 2-year colleges (Adelman 2006; Fry 2009). A study of a cohort of students starting college in the U.S. in 2003 found that by 2006 only 9% of those starting at 2-year colleges had left school with an associate's degree or vocational certificate, while 45% were out of school with no certificate; 7% had an associate's degree and were working on getting another degree; and the rest were still in school working on either an associate's or bachelor's degree (Berkner et al., 2008). Seventeen percent of those who started at 4-year colleges had not graduated and were no longer in school. This pattern of starting but failing to complete postsecondary education programs (which we refer to as "dropping out") is also revealed when older adults are asked about educational attainment, with a large percentage putting themselves in the "some college" category (U.S. Census Bureau 2011).

Although there has been no systematic research on how these dimensions of educational careers are related to substance use, prior research provides the basis for some hypotheses. Some of this research involves variables that are associated with educational attainment and which are also associated with substance use. Low levels of substance use in adolescence among individuals who go on to college have been attributed to the strong negative association between substance use and academic achievement in high school, with high school academic achievement strongly predicting later educational attainment (Bachman, et al. 2008; Crosnoe and Riegle-Crumb 2007). Levels of academic achievement in high school are generally lower among those who start their college careers at 2-year, compared to 4-year colleges, although higher than for those who do not go on to any type of college (Dowd et al., 2008; Provasnik and Planty 2008). Also, individuals who start at 2-year colleges are "in between" with respect to the socioeconomic status of their families. Although they are likely from more affluent backgrounds than noncollege youth, individuals who start 2-year colleges before transferring to 4-year colleges often do so for economic reasons (Adelman 2006; Dowd, et al. 2008; Provasnik and Planty 2008). Lower family socioeconomic status (SES) is associated with higher prevalence of substance use in early adolescence, although

higher SES youth catch up in alcohol and marijuana use (but not cigarette smoking) later in adolescence (Conrad et al., 1992; Johnston et al., 2010). Since they are “in between” in terms of high school academic achievement and family SES, individuals who start at 2-year colleges should have lower levels of substance use in adolescence than those who do not go on to any type of college, but more adolescent use than those who go straight to a 4-year school (see Timberlake, et al. 2007).

The work of Bachman and colleagues (2002; 1997) as well as others (e.g., Carter, et al. 2010; White et al., 2008) has linked the increase in drinking and marijuana use that occurs among new college students to moving away from parental supervision and living with other students who drink alcohol and use marijuana. Students at 2-year colleges are less likely than 4-year college students to experience these changes in social environment, since 2-year colleges generally do not provide dormitory housing and many 2-year college students continue to live with their parents while attending school. Thus, due to similar social environments and controls as when they were in high school, they may be less likely to increase drinking and marijuana use immediately after graduating from high school. Some support for this assumption is provided by Bell (1997), who found less marijuana use among students at commuter schools than students at non-commuter schools, and by Timberlake (2007), who found less of an increase in heavy drinking after adolescence among students who went to 2-year colleges compared to those who went to 4-year colleges. On the other hand, even if 2-year college students do not experience immediate increases in drinking and marijuana use when they transition from high school to college, they may experience “catching up” over the early adult period as they leave home or transition into 4-year college programs. With respect to cigarette smoking after high school, rates are similar across college students who do and do not live with their parents (Gfroerer, et al. 1997), suggesting that the social environments of 2-year and 4-year colleges may not differ markedly with respect to opportunities to smoke cigarettes or controls on cigarette smoking. Therefore, rates of cigarette smoking during early adulthood are likely to be relatively low for both 2- and 4-year college students compared to noncollege peers.

With regard to college completion, greater substance use in adolescence may be a marker for those students who are less likely to succeed in college programs. Timberlake (2007) found that individuals who had withdrawn from a 2- or 4-year college (as of time points in early adulthood ranging from ages 18 to 24) drank more during their high school years than individuals who were enrolled in a 4-year college. It is also possible that the future dropouts are the individuals who experience the greatest increases in alcohol use and marijuana use after high school, with use of these substances having a negative effect on college academic performance and thus contributing to failure to stay in college. Finally, it may be that increases in marijuana use and cigarette smoking occur as college dropouts leave the social controls of college.

The current study first attempts to describe educational pathways in a community sample, capturing patterns of attainment, sequencing, types of postsecondary schooling, and continuity or completion. We then examine how dimensions of heterogeneity in educational paths relate to trajectories of substance use across adolescence and into early adulthood. Although we do not test for the mechanisms through which educational paths are linked to substance use trajectories, prior findings on the likely mechanisms through which educational attainment or environment are related to substance use provide us information to form the following hypotheses:

1. Individuals who transition into 2-year colleges after high school will engage in more substance use during their high school years than those who go straight to 4-year colleges, but less than youth who do not go to college.

2. Individuals who transition into 2-year colleges after high school, compared to those who go straight to 4-year colleges, will have less of an increase in drinking and marijuana use during the transition from high school to college.
3. Individuals who transition into 2-year colleges after high school will have similar rates of cigarette smoking during the college years as those who go straight to 4-year colleges.
4. Dropping out of both 2- and 4-year colleges, compared to not dropping out, will be associated with higher rates of substance use in adolescence, greater increases in use during the transition to college, and increases in marijuana use and cigarette smoking in the post-high school period.

METHOD

DESIGN AND SAMPLE

Data are from participants in the Raising Healthy Children (RHC) project, a longitudinal study of students drawn from 10 public schools in a suburban school district in Washington State. RHC is a study of the etiology of problem behaviors as well as a randomized test of the RHC social development intervention. This family- and school-based intervention attempted to reduce risk factors for problem behaviors while increasing protective factors. The intervention was delivered at five of the project elementary schools and consisted of instructional staff development for teachers to promote classroom management and effective instructional practices; social, emotional, and cognitive skills training for students in classrooms and in a variety of after-school settings; multiple-session parenting workshops to promote effective parenting practices; and selective home-based services that reinforced material covered in the parenting workshops for families of high-risk students who exhibited academic or behavioral problems. Brief family interventions were delivered to the families of students from intervention schools during the transitions from elementary into middle school, from middle school into high school, prior to and after the student received his or her driving license, and before the transition out of high school. Additional details regarding the RHC intervention have been reported by Brown, Fleming, Catalano, Haggerty, and Abbott (2005b), Catalano et al. (2003), and Haggerty and Cummings (2006).

Although differences between the intervention and control conditions were found for frequency of alcohol and marijuana use during adolescence among students who used these substances (Brown et al., 2005a), experimental condition did not have a statistically significant ($p < .05$) association with likelihood of heavy drinking, marijuana use, or daily cigarette smoking during the time periods considered in the current study. In addition, the experimental condition was not significantly related to educational attainment by age 23 or with the likelihood of taking any specific educational path identified in the current study. To examine whether the intervention affected the relationships between educational paths and substance use that were specified in our analysis models, we ran all of the models as multiple-group models in which structural paths between educational paths and substance use growth factors were constrained to be equal across intervention conditions. These models showed evidence of good model fit (Hu and Bentler 1999), with Tucker Lewis Indices (TLI, Tucker and Lewis 1973) above .95 and root mean square error of approximation (RMSEA, Browne and Cudeck 1993) below .06. Also, the fit of these models did not differ markedly from models in which cross-group constraints were released. Differences in values of TLI for the constrained and unconstrained models were all below .01 and thus small (Cheung and Rensvold 2002). We therefore used data from participants in both the intervention and control groups for the current study, pooling participants from both conditions into single-group models.

In 1993 and 1994, 1,040 students and their parents (76% of those eligible) consented to participate in the RHC project. At recruitment, 52% were in first grade and 48% were in second grade. Prior to baseline data collection, parents provided written consent for their children's participation. After age 18, youth participants provided written consent for subsequent data collection. All procedures were approved by a University of Washington Institutional Review Board.

Annual surveys were completed every spring and there were two additional fall assessments in, for most participants, their first 2 years after high school. Parents were also surveyed annually in the spring through the high school time points. For the current study, data for the two grade cohorts in the RHC project were organized by age and we refer to time points by the average age of participants at those time points. For participants progressing through high school on schedule, the "age 15" time point was the spring of 9th grade, the "age 18" time point was the spring of 12th grade, and the "age 18.5" time point was the fall after senior year. For the fall post-high school surveys, about half of the sample completed the survey via the Web and half were interviewed in person, with sensitive questions (e.g., questions about substance use) self-administered on a laptop computer. Analyses of those randomly assigned to administration mode in the first fall survey indicated no significant pattern of mode effects in response to sensitive questions (McMorris et al., 2009). These results led to the subsequent administrations offering both modes in order to reduce costs and increase participation.

To be included in the current study, participants had to have completed surveys at their age 23 time point and answered an item on educational attainment. This excluded 119 participants from the original RHC sample, leaving an analysis sample of 921 (89% of the original sample). There were no statistically significant ($p < .05$) differences between the excluded and included participants with respect to gender, ethnicity, or low-income status of their family at the beginning of the project. Participants in the control condition were more likely to have been retained in the study and to be part of the analysis sample than participants in the intervention condition (91.8% vs. 85.8%, $X^2 = 9.41$, $p < .05$). The reason for this difference is uncertain. Of the 921 in the analysis sample, 732 had data at all of the post-high school time points.

Based on participants' self-report of race and ethnicity, the racial composition of the sample was 75.2% White, 3.4% Black, 6.4% Asian or Pacific Islander, 2.5% Native American, and 12.5% mixed; 8.0% of the sample reported they were Hispanic. At the "age 19" time point, the average age was 19.04 years (*s.d.* = 0.33, *range* 18.04 – 20.29). At age 18.5, 59.6% were living with their parents, dropping to 30.0% at age 23. An increasing portion of the sample was employed at least part time, ranging from 61.3% at age 18.5 to 71.2% at age 23. At age 18.5, 1.5% were married, increasing to 12.6% at age 23. Another 11.1% at age 18.5 and 35.4% at age 23 were living with a romantic partner. Also, an increasing number became parents, with 1.3% living with a child of their own at age 18.5 and 12.7% by age 23. Most of the sample continued to live in Washington State during the study, with over 80% of the sample using a Washington State mailing address at the age 23 time point. Thus, although the sample is heterogeneous with respect to socioeconomic status and life circumstances after high school, it is a community sample from a particular region, which may limit generalizability of the study's findings.

MEASURES

SUBSTANCE USE—Heavy drinking, marijuana use, and cigarette smoking were assessed at each time point based on participants' report of use in the prior month. Heavy drinking was defined as "5 or more drinks in a row" (Johnston, et al. 2010). Dichotomous measures of substance use were created, reflecting whether respondents reported any heavy drinking

and marijuana use or daily cigarette smoking. For the older grade cohort, the survey item regarding cigarette smoking was not asked at the fall time point immediately after high school, and thus we dropped the age 18.5 time point from analyses on cigarette smoking.

EDUCATIONAL PATHS—Categorization of individuals into educational paths was based on educational attainment as of the age 23 time point, educational status at each of the seven time points from age 18.5 to 23, and number of months enrolled in school in each post-high school year. There were 10 response options for educational attainment: "8th grade or less," "Some high school," "GED," "High school graduate," "Some trade or business school," "Trade or business school graduate," "Some college," "AA Degree," "College graduate," and "Advanced graduate or professional degree." There were also 10 response options for the current educational status at each time point, such as "trade school," "technical or vocational school," "community (2-year) college," and "university/college (4-year degree)." An initial set of categories of educational paths was defined based on common patterns identified in prior research (e.g., Adelman 2006). Next, data for individuals who did not fit criteria for these categories were inspected and additional patterns were identified. This process was followed until all individuals with complete data were categorized. The goal was to capture attainment, type of postsecondary programs, the sequencing of types of postsecondary programs, and continuity or completion. Initially, 15 different educational paths were identified, into which all participants with complete post-high school data were categorized. The criteria for membership in these categories are summarized in Table 1.

This strategy allowed for considerable variance within some groups with respect to amount of time in school. For example, the actual amount of time in school was not considered among the "dropout" categories. It should also be noted that the criteria for inclusion in the sustained college groups allowed for individuals to have some time points in the post-high school period when they were not in college, and did not require that individuals acquire a bachelor's degree within 4 years of graduating from high school. In other words, inclusion in these groups was based on either completion or continuity. The "dropout" categories involving 4-year programs required that individuals not be in a 4-year college at both the age 22 and age 23 time points. Given the shorter period of time needed to finish a 2-year degree, the "2-year college dropout" category (which required that the participant start 2-year college by the age 20 time point) required that no attainment beyond "some college" be reported at age 23.

BACKGROUND CHARACTERISTICS—In analysis of the frequencies and background characteristics of the educational path groups, we examined measures of gender, academic achievement in high school, and parents' education. High school academic achievement was based on the average response, across high school time points, to the question "In general, what were your grades like this past year?" This item offered a 5-point response option that was coded to range from 0 ("mostly E's or F's") to 4 ("mostly A's"). For parent's educational attainment, we used a dichotomous measure for whether the participant had a parent who was a college graduate with a bachelor's, graduate, or professional degree (based on parent report) at their child's high school time points.

ANALYSIS

Preliminary analyses examined the frequencies for educational attainment, educational status at each post-high school time point, and the frequency distribution of the 15 educational paths based on 732 participants who had data at each post-high school time point. As will be described in more detail below, we then collapsed some categories of educational paths and excluded some categories that typified small numbers of participants before comparing groups on background characteristics and trajectories of substance use.

This was done to focus on differences associated with 2-year versus 4-year college attendance and continuity or completion of college versus dropping out.

Before comparing educational paths with respect to substance use trajectories, we used NORM version 2.03 (Schafer 2000) to impute 40 datasets containing nonmissing values for substance use at each time point, as well as nonmissing values for variables used to sort individuals into educational path groups. Imputed values for categorical variables were rounded to the nearest observed values (Graham 2009; Schafer and Graham 2002). Substance use at each time point, educational status and residential status at each post-high school time point, months in school in each year post-high school, educational attainment at age 23, gender, and experimental condition in the RHC project were included in the imputation model. Criteria for sorting into educational path groups were then applied to each of the 40 datasets.

The relationships between educational paths and substance use were examined with latent growth curve models (Duncan et al., 1999; McArdle and Bell 2000). A piecewise model was used for each type of substance use, with linear growth and intercept (set at age 18) defining growth during the high school period and an intercept (set at age 19 in the primary model and at age 23 in a secondary analysis), and linear growth (with factor loadings set to reflect yearly change) and acceleration (i.e., “quadratic”) factors defining growth in the post-high school period. Measures of substance use in the latent growth models were treated as dichotomous categorical variables with thresholds constrained to equality across all time points (Mehta et al., 2004). The mean of the intercept at age 18 was set to 0 as a reference for the estimation of the means of the other growth factors.

Unconditional growth models were run to examine means and variances of growth factors. Conditional models were then estimated with growth factors regressed on gender (coded as male =1, female = 0), and educational paths treated as dummy variables. Gender was included to adjust for the unequal gender distribution in the educational path groups, and the possibility that gender might also be related to trajectories of substance use. The initial conditional models used the high school dropout category as the reference group. Tests of contrasts between all different pairs of educational paths were then run by changing the reference category for the educational path dummy variables. A challenge for this study was how to both capture heterogeneity in educational paths and report on the multiple contrasts between educational careers that this heterogeneity entailed. Guided by some specific hypotheses, while other tests were exploratory, we used an alpha level of $p < .05$ to organize our reporting of results, but did so with the caveat that this is a heuristic device and our findings require further testing using other samples.

Latent growth models were estimated with MPlus 4.2 (Muthén and Muthén 2006) using the Weighted Least Squares Means-Variance (WLSMV) estimator (Muthen et al., 1997). Model fit statistics and parameter estimates were averaged across models run on the 40 imputed datasets and standard errors for parameters were calculated using Rubin’s rules (Rubin 1987). Mean- and variance-adjusted chi-square and degrees of freedom were derived from the WLSMV estimator (Muthen, et al. 1997). TLI and RMSEA were also used to assess model fit. Conservative benchmarks for good model fit for structural equation models are TLI above .95 and RMSEA below .06 (Hu and Bentler 1999).

RESULTS

EDUCATIONAL ATTAINMENT, STATUS, AND PATHWAYS

As of age 23, less than 15% of the sample had completed a 4-year college degree and a third of the sample reported that “some college” was their highest level of attainment. The

percentage of individuals attending a 4-year college ranged from 20% to 24% at post-high school time points through age 22, dropping to 17% at the age 23 time point. Twenty-four percent of the sample was at a 2-year college at the first fall post-high school time point, dropping steadily to 9% of the sample as of age 23. Between 2% and 4% of the sample reported being enrolled in a vocational or trade school at any given post-high school time point. The frequencies for the 15 educational pathways initially identified based on educational attainment and sequencing and continuity of post-secondary education are shown in Table 1. None of these pathways was followed by more than 20% of the sample, and nine of the paths were followed by less than 5% of the sample. Of participants who went to college after high school, most followed paths that involved going to a 2-year college, although most participants who went to a 2-year college had neither received an associate's degree nor transferred to a 4-year school to pursue a bachelor's degree by age 23. The 2-year college dropout group was the third largest group, after continuous 4-year college students and noncollege high school graduates. Surprisingly, only 23 participants attended and completed 2-year college programs and did not go on to a 4-year college by age 23.

IDENTIFYING GROUPS FOR FURTHER COMPARISON

Because it would be difficult to make meaningful comparisons among all 15 groups, 9 of which each comprised less than 5% of the sample, we combined some groups and excluded some others. The consequences of getting a general equivalency degree (GED) was not a primary focus of our study and high school dropouts who did and did not get a GED had similar rates of substance use throughout the study period. Therefore, based on failure to complete a standard high school program, we combined GED recipients with those who left high school and did not get a GED. We also combined the two groups who started at 4-year programs and did not finish a postsecondary program, combining those with no further college as of age 23 with those who switched to 2-year colleges but had not attained an associate's or bachelor's degree. We excluded small groups, including those who started college after age 20, received only vocational/technical school training after high school, or received an associate's degree and then stopped their postsecondary schooling.

Paring down the number of groups resulted in the six groups shown in Table 2. These six groups include 85% of the sample with complete data. Two of the groups (high school dropouts and noncollege high school graduates) had no postsecondary school and comprise a little over 40% of the analysis sample. Two groups started college and either attained or were on course to receive a bachelor's degree; these two groups also make up approximately 40% of the analysis sample and are distinguished by whether they started at a 2-year college or were continuously enrolled in a 4-year college. The other two groups were "college dropouts," the larger of which attended a 2-year college but did not attain an associate's degree and did not switch to a 4-year college. The smaller dropout group started and left a 4-year college.

BACKGROUND CHARACTERISTICS

Comparisons with respect to background characteristics used data on participants with complete post-high school data. There were significant differences among these six groups for each of the three background variables. Post hoc comparisons between pairs of groups indicated that continuous 4-year college students were significantly less likely to be male, compared to members of any of the other five groups. Except for the contrast between the 2-year to 4-year transfer group and the 4-year college dropout group, all possible pairs of groups showed significant differences in academic achievement in high school. In general, the lower educational attainment groups had lower grades in high school. With respect to parent education, members of both of the noncollege groups and the 2-year dropout group were less likely to have a parent who graduated from college than each of the three groups

who spent some time in a 4-year college. The noncollege high school graduates were also significantly less likely to have a parent who went to college than 2-year college dropouts.

EDUCATIONAL PATHS AND SUBSTANCE USE

After imputing complete data on the original analysis sample of 921, sorting them into educational path groups, and then following the same collapsing and exclusion procedures described above, the average sample size of the imputed datasets to be analyzed for differences in substance use trajectories was 771. Although there was significant between-individual variation in yearly change between age 15 and 18 for each type of substance use, in preliminary conditional models we found few differences among educational paths groups in this aspect of substance use trajectories. (This is reflected in the generally parallel lines across ages 15 – 18 in Figures 1 – 3.) Thus, the linear change growth factor for the high school period was not regressed on gender or educational paths in the models presented here. Estimates for conditional and unconditional models of growth in substance use are presented in Table 3, while selected results from supplementary conditional models are shown in Table 4.

HEAVY DRINKING—The unconditional growth model for heavy drinking had good fit and there was significant between-individual variation in the intercept factor at age 19, linear change between age 15 and 18, and in both linear change and acceleration between ages 18.5 and 23. The positive mean of the intercept at age 19 reflects an increase in the prevalence of heavy drinking across the transition from the end of high school to one year later. The means of the linear and quadratic change factors for the post-high school period were not significantly different from zero, indicating that the prevalence of heavy drinking for the sample stayed flat during the post-high school period.

Observed prevalence rates for heavy drinking across time points by educational path group are plotted in Figure 1 and show relatively high rates of heavy drinking among high school dropouts at age 15, increases in rates of heavy drinking among all groups up to age 19, and rates of heavy drinking that reached between 35% and 50% by age 23 for all groups. As indicated by shared superscripted letters in Table 3, the estimates for the conditional model show a number of differences between educational paths with respect to heavy drinking during high school (i.e., the likelihood of heavy drinking at age 18). High school heavy drinking was most common for high school dropouts, followed by noncollege high school graduates, and then 2-year and 4-year college dropouts. The continuous 4-year college group was least likely to report heavy drinking during high school, significantly less likely than both noncollege groups and 2-year college dropouts. As indicated by effects on the likelihood of heavy drinking at age 19, high school dropouts remained more likely to engage in heavy drinking at the beginning of the post-high school period compared to noncollege high school graduates, 2-year college dropouts, and 2-year to 4-year college transfers. However, individuals who went straight to 4-year colleges after high school had almost caught up in their rates of heavy drinking and were significantly more likely to engage in heavy drinking than 2-year to 4-year college transfers. There were no significant differences between educational paths in linear growth during the post-high school period. With respect to acceleration, 2-year to 4-year college transfers showed more positive acceleration in the likelihood of heavy drinking compared to noncollege high school graduates, continuous 4-year college students, and 4-year college dropouts. This finding reflects a curve upward in the trajectory of heavy drinking for the transfer group during the later time points, likely corresponding with their entry into the 4-year college environment. The trajectories of the noncollege high school graduates and 4-year dropouts, in contrast, show slight decreases in rates of heavy drinking after age 21.

Two additional models were run to explore differences in trajectories of heavy drinking (see selected results shown in Table 4). First, a model was estimated in which the age 19 intercept was regressed on the age 18 intercept in order to examine the associations between educational paths and change in prevalence of heavy drinking across the transition from the high school to the post-high school period (i.e., to further assess "catch-up" effects). This model revealed a number of significant contrasts between paths with respect to likelihood of heavy drinking at age 19 when adjustment was made for likelihood of heavy drinking at the end of high school. All of the significant contrasts showed a positive effect on heavy drinking of entering a 4-year college environment. The second supplementary model assessed differences in the likelihood of drinking at the end of the study period by setting the (unadjusted) intercept of post-high school growth to age 23. This model showed that the 4-year college group had a significantly greater likelihood of heavy drinking at age 23 than the noncollege high school graduates and both the 2-year and 4-year college dropout groups.

MARIJUANA USE—In an initial unconditional model of growth in marijuana use, both the mean and variance of an acceleration factor for the post-high school period were not significantly different from zero. Therefore, a linear model of growth after high school was used. Variances in both intercepts (i.e., age 18 and 19) and both linear change factors (i.e., during high school and after high school) were statistically significant. The mean of change during high school was positive and significant and the mean of change post high school was negative, reflecting increase in the sample prevalence of marijuana use during high school, followed by a decrease across the 5 years after high school. The mean of the age 19 intercept was not significantly different from zero, indicating little change in marijuana use from the end of high school to one year later.

Observed rates for marijuana use across time points by educational path group are shown in Figure 2 and illustrate that high school dropouts had the highest rates of marijuana use throughout the study, while other educational groups shifted positions during the post-high school period between ages 19 and 23. The results of the conditional model revealed statistically significant differences between groups during the high school period. High school dropouts were significantly more likely to use marijuana than any other group at age 18, while the two groups that went on to college and persisted in pursuing a 4-year degree were the least likely to use. Dropouts from 2-year colleges also were more likely to use marijuana in high school than members of the two sustained college groups, and 4-year college dropouts had significantly more high school use than the continuous 4-year group. The ordering of the groups (and most of the significant contrasts between groups) with respect to marijuana use at age 19 was almost the same as at age 18, although at age 19, the 2-year to 4-year transfers were significantly less likely to use marijuana than 4-year dropouts. There were some differences in growth after high school. The continuous 4-year college group had a more positive rate of increase in likelihood of marijuana use compared to high school dropouts, noncollege high school graduates, and 2-year college dropouts. The 2-year to 4-year transfers and the 4-year dropouts also had greater increases relative to the 2-year college dropouts.

As would be expected given that the ordering of groups remained the same across the transition from high school to beginning of the post-high school period, there were no significant contrasts in effects on the age 19 intercept when adjusted for age 18 intercept. Setting an unadjusted intercept at age 23 indicated that high school dropouts still had significantly higher rates of marijuana use than all groups except 4-year college dropouts at the end of the study period. In addition, 2-year college dropouts had significantly lower likelihood of use at age 23 than noncollege high school graduates and 4-year dropouts at age 23. Dropouts from 4-year colleges were also significantly more likely to use marijuana at age 23 than 2-year to 4-year college transfers.

DAILY CIGARETTE SMOKING—As with marijuana use, an initial unconditional model of growth in daily cigarette smoking indicated that both the mean and variance for an acceleration factor were not significantly different from zero, and therefore, a linear model of growth in the post-high school period was used. This unconditional model fit well, with significant between-individual variation in the four growth factors. The means for the growth factors reflect increases in daily cigarette smoking during high school, an increase from age 18 to age 19, and little change in prevalence of daily smoking between ages 19 and 23.

As seen in Figure 3, the trajectories of observed rates of daily cigarette smoking for the six educational path groups remained roughly parallel across adolescence up through age 23. The conditional model for daily cigarette smoking again showed statistically significant differences in high school use related to completion of high school and pursuit of post-high school education. Among those who went to college, both 2-year college dropouts and 4-year college dropouts were more likely to smoke cigarettes daily at the end of high school than the continuous 4-year college group. As with marijuana use, the ordering of groups was stable across the transition out of high school, although 4-year college dropouts were significantly more likely to smoke cigarettes daily at age 19 than 2-year to 4-year college transfers. There were no significant differences between educational paths in yearly change in likelihood of daily cigarette smoking in the post-high school period. As a result of the parallel trajectories of daily cigarette smoking, regressing the age 19 intercept on the age 18 intercept revealed no significant “catch-up” effects, and setting an unadjusted intercept at age 23 revealed the same pattern of differences in daily cigarette smoking at age 23 as found at age 19.

DISCUSSION

The results of this study provide new information on the relationship between education and substance use, expanding the findings of previous studies based on measures of only educational attainment or status at a given time point. Specifically, we examined different trajectories of substance use among individuals who followed varying pathways of educational pursuits. Our results showed that the path taken is as important as the final level of attainment in relation to changes in substance use during the post-high school period.

Approximately 40% of the sample had either attained a bachelor’s degree or were making progress towards one. Some started off at 4-year colleges, while a substantial portion started at 2-year colleges. Support for our first hypothesis was mixed in that, while 2-year college dropouts had relatively high rates of substance use during high school compared to both continuous college groups, the 2-year to 4-year transfers had similar levels of substance use during high school compared to the continuous 4-year college group. However, the sustained college paths differed in trajectories of substance use in that those that went straight to 4-year colleges had higher levels of heavy drinking as they entered college. For those who started at 2-year colleges and transferred to 4-year colleges, the increase in heavy drinking was delayed and these students drank relatively little in the immediate post-high school years. The 2-year to 4-year college transfer group also had the lowest rate of marijuana use of all of the groups examined throughout the post-high school period, although differences in prevalence of marijuana use between 2- to 4-year transfers and continuous 4-year college students were not statistically significant and both increased their rate of marijuana use after high school. As we hypothesized, the two sustained college groups had similarly low rates of daily cigarette smoking across the entire time period.

Among individuals who went to college, some sustained their pursuit of a 4-year degree, while others dropped out before completing college. Supporting our fourth hypothesis, we

found differences between groups in each type of substance use that were associated with whether individuals who started postsecondary programs dropped out or stayed in these programs. More 2-year college dropouts used marijuana and smoked cigarettes daily in high school and afterwards than 2-year college students who went on to pursue 4-year degrees. In addition, 4-year college dropouts were more likely to be daily cigarette smokers in high school and were more likely to smoke cigarettes daily after high school than individuals who started in 4-year colleges and sustained their pursuit of a degree. Dropouts from 4-year colleges also were more likely to use marijuana than 2-year to 4-year college transfers at both the beginning and end of the post-high school period, although there was not a significant increase in marijuana use for the 4-year dropouts relative to other groups during this period. An unexpected finding, contrary to what we had hypothesized, was that 2-year college dropouts declined in their likelihood of marijuana use after high school relative to the three other groups who went to college.

Other findings from our study corroborate prior research (e.g., Bachman, et al. 2008; O'Malley and Johnston 2002; Timberlake, et al. 2007). For instance, we found that high school dropouts had the highest prevalence of each type of substance use during high school and that these differences were maintained with respect to marijuana use and daily cigarette smoking in the post-high school period. At each of the post-high school time points, over 55% of the high school dropouts were daily smokers and over a third had used marijuana in the past month. Other groups caught up with the high school dropouts in terms of heavy alcohol use by the time they reached their early 20s. At most time points after age 20, most groups had prevalence rates of heavy drinking in the past month between 40% and 50%. Noncollege high school graduates had mean trajectories of marijuana use and daily cigarette smoking that were lower than high school dropouts but higher than the groups with some college exposure.

Our study did not include a test of the mechanisms that may account for differences in substance use among educational paths. Differences in background characteristics of educational path groups point to selection effects, with higher educational attainment characterized by better academic achievement in high school and a greater likelihood of having a parent with a 4-year degree. Going to and staying in college were also predicted by less substance use during high school. With respect to cigarette smoking, group differences in rates of daily cigarette smoking in early adulthood could be largely explained by differences in rates in adolescence. In addition to selection effects, life circumstances that overlap with education may explain differences in substance use. Some research (e.g., Carter, et al. 2010; Gfroerer, et al. 1997; White, et al. 2006) shows that moving out of the parents' home explains the "catch-up" effects on drinking and marijuana use more so than college status. The timing of this transition likely accounts for the delayed increase in heavy drinking among 2-year to 4-year college transfers, since many of them continue to live with their parents in the year or two after high school. Further, other life circumstances, such as involvement in a committed romantic relationship (Fleming et al., 2010), may overlap with educational pathways and account for some differences in substance use trajectories. Early marriage and parenthood are perhaps more common among the noncollege groups and may explain earlier desistence in heavy drinking and marijuana use among the noncollege high school graduates and 2-year college dropouts (Labouvie 1996). Therefore, future research should examine whether these and other mechanisms account for the associations between educational pathways and substance use.

Although we have examined dimensions of heterogeneity in educational careers that have not received much attention in prior research on substance use, we were forced to make simplifying decisions in order to focus on differences in substance use related to paths involving 2-year versus 4-year colleges and paths characterized by continuity in college

careers versus dropping out. For comparisons of substance use trajectories, we excluded some smaller groups, such as groups characterized by going to vocational school programs or completing a 2-year A.A. degree program but not transferring to a 4-year college. A larger data set might allow for examining the substance use trajectories of these smaller groups. We also combined high school dropouts who got a GED and those who did not. Secondary analyses indicated that these two groups did not did not differ markedly with respect to substance use trajectories, but a larger sample size might reveal important differences between these two groups. Among the college dropout groups, we did not examine the amount of time individuals spent in college. In the 2-year college dropout group, there was a wide range in the number of time points or number of months in which individuals were enrolled in college. It may be that, within this group, more time enrolled in a 2-year college is related to less substance use. Finally, we were limited by identifying educational paths with our last data point at age 23. Many individuals in the "dropout" categories may return to school and complete programs, and some in the noncollege groups are likely to enroll later. Our criteria for inclusion in the two sustained college groups allowed for individuals who had not yet acquired their degrees by the spring of age 23 to be included in these groups if they were still enrolled in college. Some may withdraw from school just short of attaining a degree.

There are other potential limitations of this study. First, half of the sample received services as part of a test of a preventive intervention. Although there was no evidence that the intervention affected levels of or relationships among study variables, the presence of the intervention trial within the RHC project may limit the generalizability of the findings. Second, the study is based on a community sample, most of whom were still living in Washington State through the last time point. States vary in the extent and structure of their postsecondary education systems, with some, including Washington State, having more extensive 2-year college programs than others (Dowd, et al. 2008). Nevertheless, the proportion of the sample in 2-year college versus 4-year college at any given time point was similar to national averages (Fry 2009), and the path of 2-year to 4-year college transfer is also common in national samples (Berkner, et al. 2008).

An additional limitation is that many of the participants attended the same schools. Of those that were in a community college at the age 19 time point, approximately a fourth were attending the community college closest to the school district from which the sample was enrolled in the RHC study. The rest of those in 2-year colleges were dispersed in more than 20 other community colleges. Of those in 4-year colleges at the age 19 time point, approximately a fourth were attending the University of Washington. Dependency with respect to students clustered in the same schools may potentially be confounded with the effects of pursuing different educational paths. There is a danger of ecological fallacies in attributing, for example, a 4-year college effect to what may be a University of Washington effect. We note, however, that there is nothing out of the ordinary about the most commonly attended 2-year college, and that the University of Washington is typical (e.g., in terms of substance use norms, the percentage of the student body living in dormitories, and the presence of a Greek system) of large state universities. Nonetheless, using data on large nationally representative samples to further investigate heterogeneity in educational paths and the relationships between this heterogeneity and substance use trajectories will contribute to the generalizability of our findings.

Our findings suggest that more nuanced measures of educational careers related to continuity and sequencing of types of postsecondary programs reveal specific relationships with substance use. Generally, the results indicate that using 2-year college as a stepping stone to a 4-year degree carries the least risk for escalation of substance use in the immediate post-high school years and that dropping out of postsecondary programs is

associated with more substance use. These findings have implications for prevention of substance use problems in early adulthood. First, the findings support the use of universal heavy drinking prevention programs in early adulthood, since all groups accelerate in their use of alcohol post high school up until the early 20s. However, the results also highlight the need for interventions that target the increases in heavy drinking associated with entry into 4-year college environments. Second, the findings for marijuana use support targeting individuals in late adolescence and in the immediate post-high school years who have low levels of high school academic achievement and who drop out of school. However, 4-year college students are also potential targets for prevention of increases in marijuana use in the years after high school. Finally, the findings support targeting smoking prevention at individuals who are not successfully pursuing 4-year college degrees, and especially at high school dropouts.

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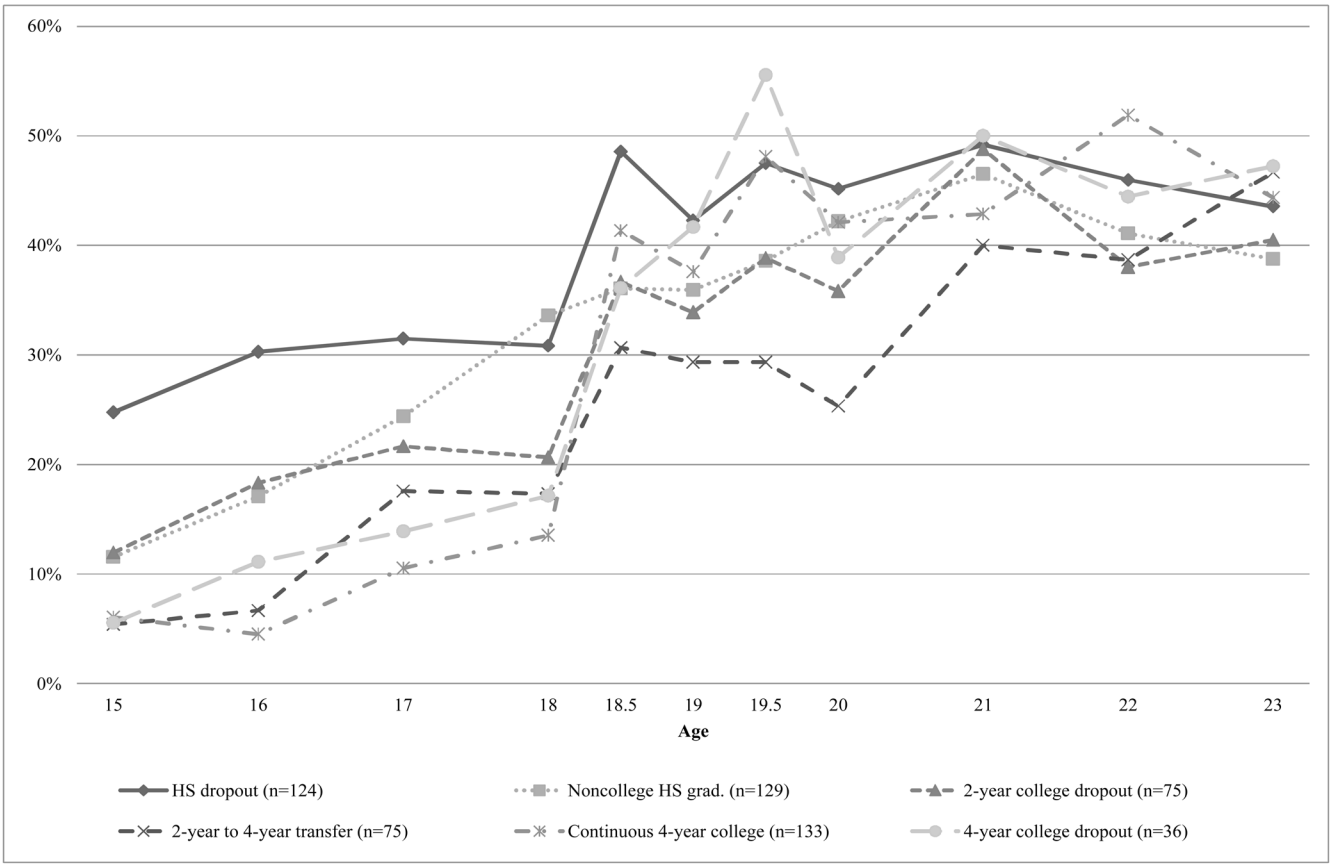

Figure 1.
Any heavy drinking in prior month at age 15 – 23 time points for six educational paths. Note HS = high school; grad. = graduate.

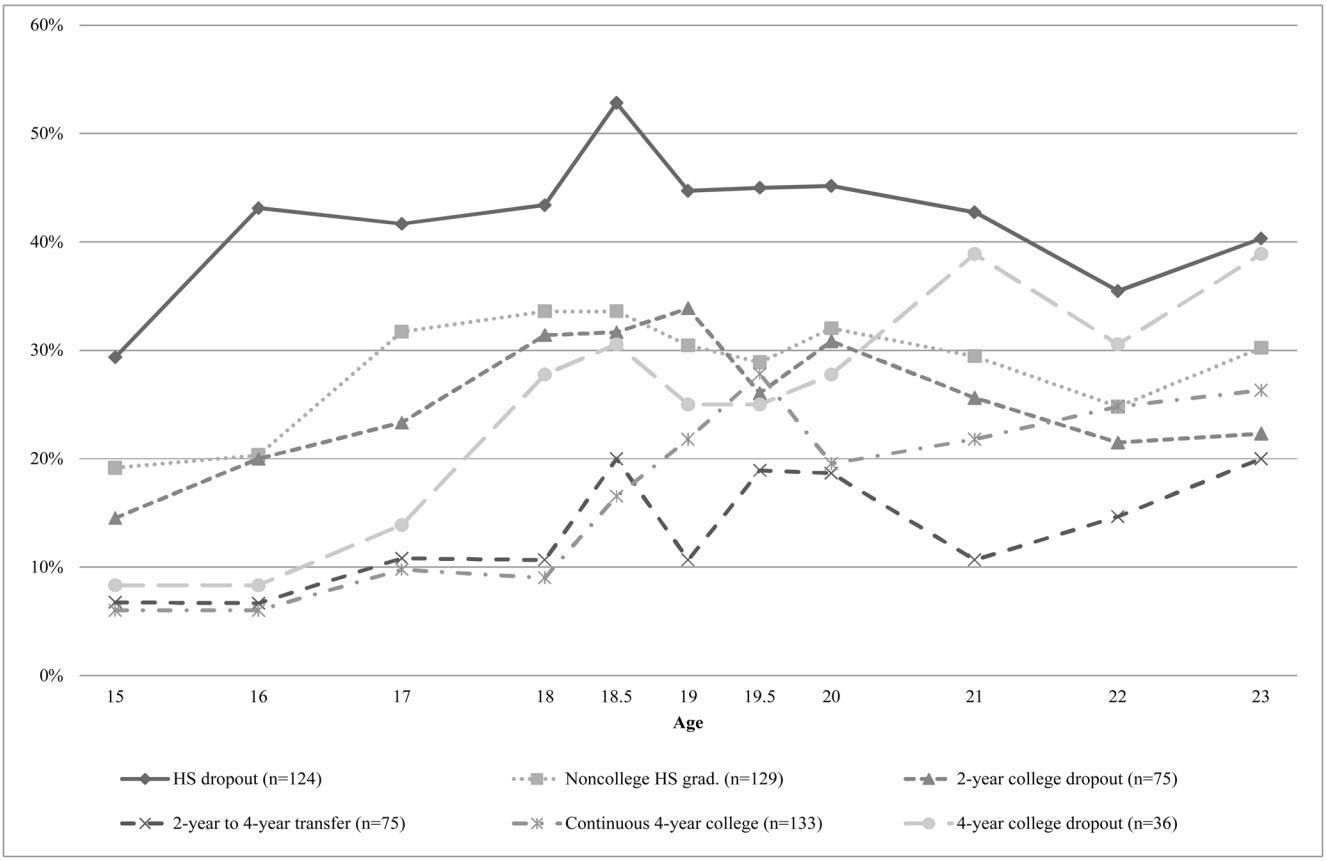

Figure 2.

Any marijuana use in prior month at age 15 – 23 time points for six educational paths. Note HS = high school; grad. = graduate.

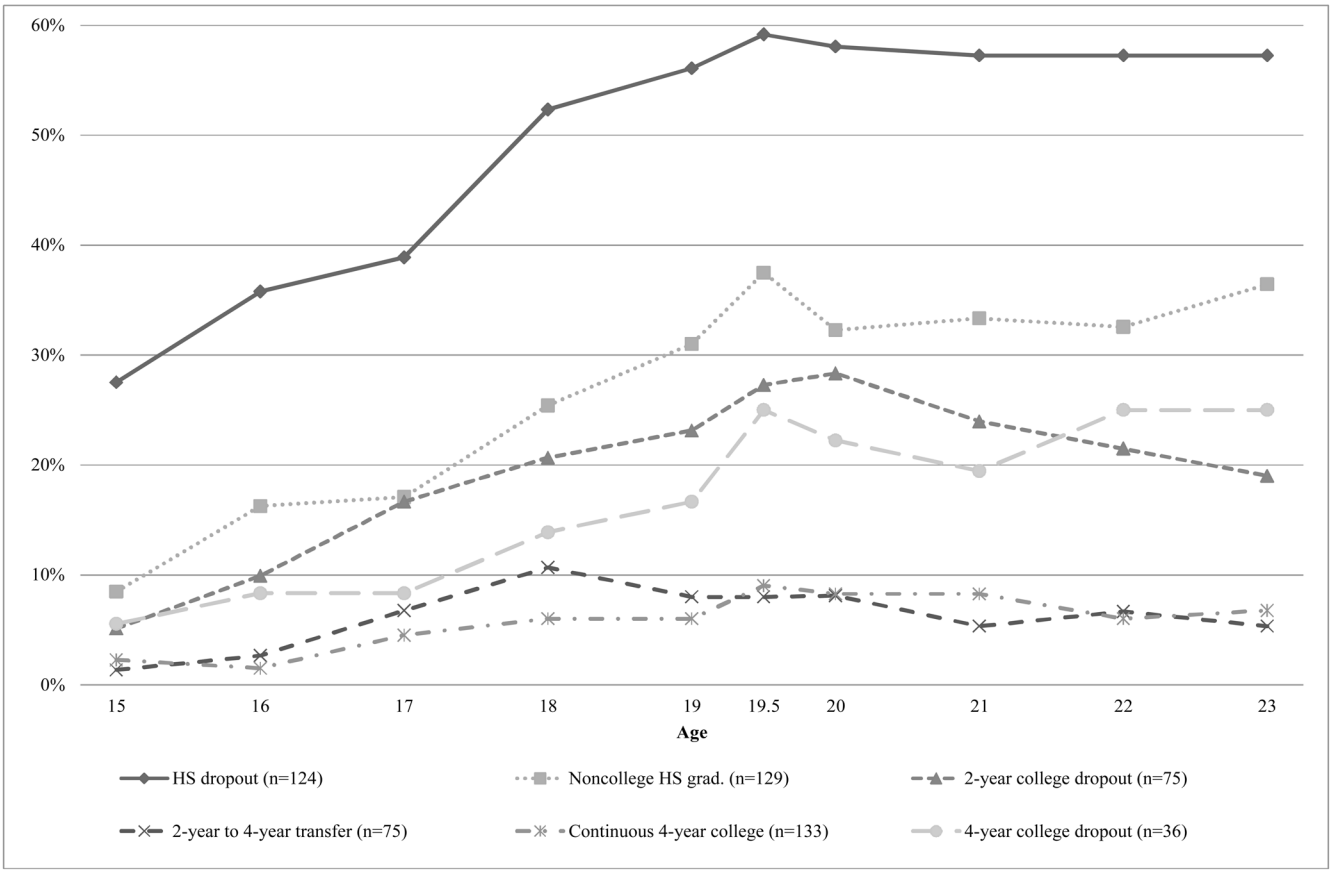

Figure 3.
Any daily cigarette smoking in prior month at age 15 – 23 time points for six educational paths. Note HS = high school; grad. = graduate.

Table 1

Criteria and Frequencies for 15 Educational Paths Based on 732 Participants With Data at all Post-High School Time Points

#	Path	Attainment	Sequencing/Continuity	Frequency n (%)
1	Noncompleters, no GED	Less than GED	No time point in college or "technical or trade" school age 18.5 – 23	70 (9.6)
2	Noncompleters with GED	GED	No time point in college or "technical or trade" school age 18.5 – 23	54 (7.4)
3	Noncollege high school graduates	High school graduate	No time point in college or "technical or trade" school age 18.5 – 23	129 (17.6)
4	2-year college dropout	Some college	In a 2-year college at least one 18.5 –20 time point; no time point in 4-year college	121 (16.5)
5	2-year to 4-year college transfer	Some college, A.A., bachelor's, or graduate/ professional degree	At 2-year college at 18.5 – 20 time point followed by time point at 4-year college; graduate or in 4-year college through age 22	75 (10.2)
6	Continuous 4-year college	Some college, Bachelor's, or graduate/ professional degree	No time point at 2-year college; if "some college", at 4-year college by age 20 and either at 4-year college at 2 or 3 age 21 to 23 time points or at school at either age 22 or 23 time points and in college for at least 25 months between ages 18.5 and 23	133 (18.2)
7	4-year college dropout, no other college	Some college	Start at 4-year college by age 20; not in college at age 22 or 23 time points; no time point in 2-year college	20 (2.7)
8	4-year college dropout, transfer to 2-year college but not complete	Some college	Start at 4-year college by age 20; in a 2- year college at a subsequent time point	16 (2.2)
9	4-year college dropout, transfer to 2-year college and complete AA degree	A.A. degree	Start at 4-year college by age 20; in a 2- year college at a subsequent time point	9 (1.2)
10	Vocational school dropout	Some technical or trade school	Not in 2-year or 4-year college at any 18.5 – 23 time point	20 (2.7)
11	Vocational school graduate	Complete technical or trade school	Not in 2-year or 4-year college at any age 18.5 – 23 time point	20 (2.7)
12	2-year college graduate, no 4-year college	A.A. degree	In 2-year college at some 18.5 – 23 time point; never in a 4-year college	23 (3.1)
13	2-year to 4-year transfer, but dropout	Some college	Start at 2-year college by age 20; switch to 4-year college; not in school at age 22 or 23 time points	10 (1.4)
14	Start 2-year college late	Some college	Start at 2-year college after age 20	29 (4.0)
15	Start 4-year college late	Some college	Start at 4-year college after age 20; no time at 2-year college; still in college at 22 or 23	3 (0.4)
	Total			732 (100)

Attainment measured as of the age 23 time point. GED = General Equivalency Degree; A.A. = Associate of Arts

Table 2

Groups Sizes for Six Paths Compared With Respect to Trajectories of Substance Use Based on Cases With Complete Post-high School Data

Path	n
High school dropouts (Groups 1 & 2 in Table 1)	124
Noncollege high school graduates (Group 3 in Table 1)	129
2-year college dropout (Group 4 in Table 1)	121
2-year to 4-year college transfer (Group 5 in Table 1)	75
Continuous 4-year college (Group 6 in Table 1)	133
4-year college dropout (Groups 7 & 8 in Table 1)	36

Table 3

Estimates for Unconditional and Conditional Models of Growth in Heavy Drinking, Marijuana Use, and Daily Cigarette Smoking

	Heavy Drinking		Marijuana Use		Daily Cigarette Smoking	
	Unconditional Coeff. (SE)	Conditional Coeff. (SE)	Unconditional Coeff. (SE)	Conditional Coeff. (SE)	Unconditional Coeff. (SE)	Conditional Coeff. (SE)
Yearly change age 15 to 18						
Intercept	0.143* (0.022)	0.102* (0.042)	0.121* (0.020)	0.107* (0.045)	0.195* (0.021)	0.221 (0.038)
Likelihood at age 18						
Intercept	0	0	0	0	0	0
HS dropout		0[a,b,c,d,e]		0[a,b,c,d,e]		0[a,b,c,d,e],
Noncollege HS graduate		−0.373[a,f,g] (0.111)		−0.439[a,f,g] (0.111)		−0.674[a,f,g] (0.131)
2-year dropout		−0.510 [b,h] (0.114)		−0.588[b,h,i] (0.111)		−0.885[b,h,i] (0.135)
2-year to 4-year transfer		−0.748[c,f] (0.148)		−1.108[c,f,h] (0.159)		−1.407[c,f,h] (0.200)
Continuous 4-year		−0.949[d,g,h] (0.140)		−1.171[d,g,,i,j] (0.146)		−1.635[d,g,,i,j] (0.184)
4-year dropout		−0.691[e] (0.186)		−0.721[e,j] (0.193)		−0.974[e,j] (0.251)
Male		0.048 (0.081)		0.023 (0.080)		−0.250* (0.098)
Likelihood at age 19						
Intercept	0.477* (0.044)	0.301* (0.096)	0.057 (0.039)	−0.047 (0.082)	0.149* (0.039)	0.167* (0.079)
HS dropout		0[a,b,c]		0[a,b,c,d,e]		0[a,b,c,d,e]
Noncollege HS graduate		−0.283[a] (0.109)		−0.384[a,f,g] (0.120)		−0.619[a,f,g,h] (0.136)
2-year dropout		−0.316[b] (0.110)		−0.471[b,h,i] (0.123)		−0.898[b,f,i,j] (0.140)
2-year to 4-year transfer		−0.492[c,d,e] (0.138)		−0.846[c,f,h,j] (0.156)		−1.546[c,g,i,k] (0.195)
Continuous 4-year		−0.174[d] (0.119)		−0.751[d,g,i] (0.132)		−1.684[d,h,j,l] (0.180)
4-year dropout		−0.091[e] (0.174)		−0.427[e,j] (0.187)		−0.789[e,k,l] (0.228)
Male		0.115 (0.076)		0.168* (0.083)		−0.041 (0.099)
Yearly change age 18.5–23						
Intercept	0.052 (0.029)	−0.014 (0.067)	−0.038* (0.011)	−0.074* (0.025)	−0.017 (0.010)	−0.018 (0.024)
HS dropout		0		0[a]		0
Noncollege HS graduate		0.157 (0.096)		0.023[b] (0.036)		0.009 (0.032)
2-year dropout		0.045 (0.092)		−0.028[c,d,e] (0.036)		−0.013 (0.036)

	Heavy Drinking		Marijuana Use		Daily Cigarette Smoking	
	Unconditional Coeff. (SE)	**Conditional Coeff. (SE)**	**Unconditional Coeff. (SE)**	**Conditional Coeff. (SE)**	**Unconditional Coeff. (SE)**	**Conditional Coeff. (SE)**
2-year to 4-year transfer		−0.057 (0.108)		0.055[c]		−0.042 (0.062)
Continuous 4-year		0.122 (0.089)		0.111[a,b,d] (0.036)		0.000 (0.046)
4-year dropout		0.107 (0.145)		0.098[e] (0.051)		0.008 (0.051)
Male		0.029 (0.060)		0.077* (0.023)		0.017 (0.025)
Acceleration age 18.5–23						
Intercept	−0.007 (0.007)	−0.004 (0.017)	--	--	--	--
HS dropout		0				
Noncollege HS graduate		−0.036[a] (0.024)				
2-year dropout		0.006 (0.023)				
2-year to 4-year transfer		0.050[a,b,c] (0.027)				
Continuous 4-year		−0.003[b] (0.022)				
4-year dropout		−0.034[c] (0.035)				
Male		0.001 (0.015)				
Covariances						
Yearly change 15–18 with:						
Likelihood at age 18	0.066* (0.032)	0.073* (0.034)	0.129* (0.028)	0.150*	0.060* (0.019)	0.078* (0.025)
Likelihood at age 19	0.076* (0.018)	0.081* (0.018)	0.098* (0.016)	0.109* (0.018)	0.064* (0.014)	0.086* (0.018)
Yearly change 18.5–23	0.001 (0.017)	0.000 (0.018)	−0.010 (0.005)	−0.012 (0.006)	0.009 (0.005)	0.012 (0.007)
Acceleration 18.5–23	−0.002 (0.004)	−0.002 (0.005)				
Likelihood at age 18 with:						
Likelihood at age 19	0.566* (0.034)	0.577* (0.034)	0.744* (0.027)	0.721* (0.030)	0.884* (0.021)	0.850* (0.027)
Yearly change 18.5–23	−0.117* (0.033)	−0.119* (0.034)	−0.077* (0.011)	−0.076* (0.012)	−0.032* (0.009)	−0.042* (0.011)
Acceleration 18.5–23	0.011 (0.009)	0.014 (0.009)				
Likelihood at age 19 with:						
Yearly change 18.5–23	−0.069* (0.024)	−0.070* (0.025)	−0.047* (0.009)	−0.048* (0.009)	−0.032* (0.007)	−0.046 (0.009)
Acceleration 18.5–23	0.001 (0.006)	0.002 (0.006)				
Yearly change 18.5–23:						
Acceleration 18.5–23	−0.027* (0.009)	−0.026* (0.009)				

	Heavy Drinking		Marijuana Use		Daily Cigarette Smoking	
	Unconditional Coeff. (SE)	**Conditional Coeff. (SE)**	**Unconditional Coeff. (SE)**	**Conditional Coeff. (SE)**	**Unconditional Coeff. (SE)**	**Conditional Coeff. (SE)**
Variance components						
Linear change 15–18	0.050* (0.020)	0.054* (0.021)	0.078* (0.017)	0.091* (0.019)	0.041* (0.012)	0.054* (0.016)
Likelihood at age 18	0.719* (0.067)	0.699* (0.071)	0.928* (0.052)	0.919* (0.059)	0.980* (0.032)	0.975* (0.040)
Likelihood at age 19	0.710* (0.026)	0.706* (0.026)	0.816* (0.023)	0.027* (0.005)	0.977* (0.012)	0.973* (0.017)
Yearly change age 18.5–23	0.145* (0.035)	0.144* (0.035)	0.026* (0.004)	0.807* (0.024)	0.016* (0.003)	0.023* (0.005)
Acceleration age 18.5–23	0.007* (0.002)	0.007* (0.002)				
χ^2	64.667*	104.278	101.977*	155.875*	77.474*	115.547
Df	46	88	52	100	41	83
RMSEA	0.023	0.015	0.035	0.027	0.034	0.022
TLI	0.995	0.995	0.994	0.991	0.999	0.998

Notes: Results based on average across estimates run on 40 imputed datasets. The average number of cases in each dataset was 771. Standard errors are estimated based on within-and between-imputation variances using Rubin's rules. Significant differences (p <.05) between pairs of educational paths for a given growth factor are indicated by a shared superscripted letter.

* p < .05;

Coeff.= coefficient; *SE* = standard error; *df* = degrees of freedom; *RMSEA* = root mean square of approximation; *TLI* = Tucker Lewis index; HS = high school.

Table 4

Effects of Educational Paths on Age 19 Substance Use Adjusted for Age 18 Use and Effects of Educational Paths on Use at Age 23

	Heavy Drinking		Marijuana Use		Daily Cigarette Smoking	
	Age 19 Adjusted for Age 18 Use	Age 23	Age 19 Adjusted for Age 18 Use	Age 23	Age 19 Adjusted for Age 18 Use	Age 23
	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)
Educational path						
HS dropout	$0^{a,b}$	0	0	$0^{a,b,c,d}$		$0^{a,b,c,d,e}$
Noncollege HS graduate	$0.026^{c,d}$ (0.109)	-0.225^{a} (0.138)	−0.040 (0.103)	$-0.293^{a,e,f}$ (0.136)	−0.031 (0.118)	$-0.585^{a,f,g,h}$ (0.138)
2-year dropout	$0.105^{e,f}$ (0.120)	-0.044^{b} (0.137)	−0.010 (0.104)	$-0.583^{b,e,g}$ (0.142)	−0.127 (0.128)	$-0.949^{b,f,I,j}$ (0.144)
2-year to 4-year transfer	0.127^{g}(0.142)	0.087 (0.164)	0.022 (0.179)	$-0.625^{c,f,h}$ (0.161)	−0.320 (0.193)	$-1.714^{c,g,J,k}$ (0.244)
Continuous 4-year	$0.610^{a,c,e,g}$ (0.155)	$0.273^{a,b,c}$ (0.143)	0.168 (0.132)	-0.308^{d} (0.142)	−0.259 (0.169)	$-1.686^{d,h,j,l}$ (0.182)
4-year dropout	$0.479^{b,d,f}$ (0.190)	-0.202^{c} (0.226)	0.138 (0.162)	$-0.034^{g,h}$ (0.210)	0.060 (0.197)	$-0.757^{e,k,l}$ (0.224)
Male	0.075 (0.075)	0.252^{*} (0.091)	0.150^{*} (0.072)	0.474^{*} (0.093)	0.177 (0.086)	0.028 (0.104)
Age 18 intercept	0.826^{*} (0.086)		0.784^{*} (0.049)		0.872^{*} (0.039)	

Notes: Other parameters from these models (not shown) are similar to those shown in Table 3. Results based on average across estimates run on 40 imputed datasets. The average number of cases in each dataset was 771. Standard errors are estimated based on within- and between-imputation variances using Rubin's rules. Significant differences ($p<.05$) between pairs of educational paths for a given growth factor are indicated by a shared superscripted letter.

$^{*}p < .05$;

Coeff.= coefficient; *SE* = standard error; HS= high school.